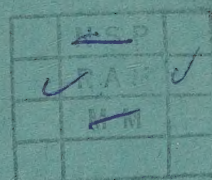


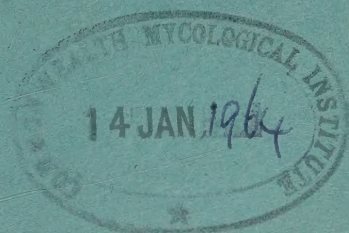


INDIAN CENTRAL JUTE COMMITTEE

**Annual Report
of the
Jute Agricultural Research Institute
For the year 1961-62**



**CALCUTTA
1963.**



ANNUAL REPORT OF THE JUTE AGRICULTURAL RESEARCH INSTITUTE FOR THE YEAR 1961-62.

INTRODUCTION

The area under the Farm is 104.68 acres out of which 101.44 acres has been fenced. 3.24 acres is a separate block without any fencing. As this area is not sufficient for our requirements, the West Bengal Government was requested to acquire for us about 50 acres of low and medium land near this Institute. The necessary formalities in this connection have been completed and it is expected that the land will be made available very soon.

During the year under report an area of 47.38 acres was under cultivation during the Kharif season, of which 27.44 acres was with experimental jute, 3.32 acres under seed jute, 4.65 acres under experimental roselle and mesta, 1.48 acres under seed plot for mesta and roselle ; of the rest, 7.49 acres was under dhaincha and cowpea for green manuring, and 3 acres was under ramie and agave for maintenance of the types.

Out of the remaining 57.30 acres, 3.31 acres were fallow, 5.42 acres was under tanks, 41.82 acres was under road, buildings, lawns and trees. The Crop Weather Observatory occupied 0.75 acres while the gamma field had 6 acres.

1.40 acres of jute area was under transplanted paddy, which followed jute as a second crop.

During the winter season, total area under cultivation was 16.55 acres, of which 1.50 acres was under gram, 5.00 acres under mustard, 6.75 acres under pea, 0.94 acre under cowpea, 1.25 acres under gram for green manuring and 1.00 acre under pea for green manuring. An area of 0.11 acre was under sunn-hemp trial. Labour position during the year under report did not improve. Dearth of labour supply was keenly felt, specially during the time of weeding. Sowing was much delayed for want of sufficient rain in time.

Preparations are being made to provide irrigation facilities to important experimental plots.

Although drought and flood damaged the crop in certain areas, the season, though late, was on the whole favourable for growth of jute. The total rainfall as recorded in this farm was 1406.9 mm with 105 days of rain as against 1394.9 mm with 106 days in the previous year. The distribution has been as follows :

		Total rainfall mm	Maximum rainfall mm	Rainy days
January	...	27.9	24.1	2
February	...	31.3	14.0	7
March	...	9.1	9.1	1
April	...	15.2	15.2	1
May	...	225.1	69.9	9
June	...	252.0	45.7	13
July	...	79.5	21.8	18
August	...	349.0	128.0	24
September	...	240.3	67.6	19
October	...	177.5	46.5	11
November	...	00.0	—	—
December	...	00.0	—	—

Results of practical utility obtained during the period under report

In areas where jute is grown as a single crop, the late types of *C. capsularis*, JRC-206 and EC-4142 are likely to give higher yields than JRC-212. Comparative trials at the central station have shown that the *olitorius* improved types, JRO-632 and JRO-514, give better yields as compared to the *capsularis* improved strains, JRC-212 and JRC-206.

Trials conducted in cultivators' plots in different States indicate that in Orissa, the *capsularis* strains, D154 and JRC-212 are distinctly better than locals. In U.P., JRC-5854 proved best, followed in order

by JRC-212 and JRC-321 ; among *olitorius* types, JRO-753 was found to be the best.

Under conditions prevailing in the central station, three strains of Mesta (*Hibiscus cannabinus*), H.C.583, H.C.867, and H.C.584 proved superior to the control, M.T. 15. Among six species of minor fibres tried out at Nilganj, *Urena sinuata* was found to be the most promising.

New types of JRO-632 with non-shattering pods, higher yield, resistance to semilooper attack and root-rot and other desirable characters have been isolated from irradiated materials. A non-branching type of JRC-919 giving slightly higher yield than the parental branching strain has been obtained by X-ray irradiation.

In *C. olitorius*, foliar spray of urea at 22.5 Kg. N/ha was as effective as supplying 45 Kg. N/ha through $(\text{NH}_4)_2 \text{SO}_4$ as top dressing. Foliar application of urea was more effective than that of $(\text{NH}_4)_2 \text{SO}_4$.

The presence of the trace element, boron, helps nitrogen metabolism and its absence leads to slow growth and delayed maturity.

Capsularis jute responds better to higher doses of N than *olitorius*.

Under normal conditions, availability of N from urea and ammonium sulphate is similar. But when the plot is treated for 5 consecutive years with ammonium sulphate and superphosphate, the availability of N from urea is more.

Use of *Hydrilla*, a naturally occurring weed of stagnant pools, reduced the retting period and improved the colour of jute.

A process for degumming of ramie has been standardised. The process is a combination of bacterial and chemical treatments. Crude ribbons are partially retted by the action of a specific strain of *Bacillus subtilis*. This is followed by treatment with 75% NaOH and bleaching with 1% hypochlorite solution.

Continuous cropping of plots with jute lowers the pH of the soil and results in recurrent incidence of stem-rot and root-rot. The attack is reduced by treatment with lime, potash and organic manures, particularly green manuring with Dhaincha. Liming is also effective in reducing foot-rot in roselle.

Nupserha bicolor is an important pest of *C. olitorius*. The diapausing larvae continued morphogenesis when the initial exposure to low soil moisture (less than 2%) was followed by exposure to high soil moisture (about 16%). No development occurred when high moisture in the beginning was followed by low moisture. Thus, dry weather during winter months leads to increase in population of the pest. *Nupserha* is a borer ; as such, external application of insecticides is of little value. Two natural parasites, *Neocatolaccus nupserhae* and *Norbanus acuminatus* reduce the incidence of *Nupserha* by almost 12 and 9% respectively.

The higher egg laying capacity of the insect leading to maximum damage by *Apion* occurs during August. This suggests that control measures against *Apion* during this month are most effective.

I. SECTION OF GENETICS AND PLANT BREEDING

I.(a) Plant Breeding

Short summary of work done last year.— 44 types, 42 *C. capsularis* and 2 *C. olitorius* were grown and in all, 60 promising selections, 53 *capsularis* and 7 *olitorius* were carried forward. 60 selections, 20 *capsularis* and 40 *olitorius* were grown for progeny testing in two separate nurseries. 18 promising lines, 5 *capsularis* and 13 *olitorius* were retained for further tests. Five *capsularis* replicated micro-plot tests were conducted to test mainly the yield performance of certain types carried forward from the previous year's nursery tests and 'A' trials. None of the types proved superior to the recommended variety JRC-212. In the *capsularis* varietal trial, EC-4142, JRC-206 and JRC-212 proved significantly superior to D154 at 1% level, yielding about 18, 18 and 12 per cent higher respectively. Both EC-4142 and JRC-206 are about one month late in maturity as compared to JRC-212 and D154. The new improved types, JRC-

9527, JRC-6382 and JRC-8429 proved significantly superior to D154 at 5% level, yielding about 10, 9 and 8 per cent higher respectively. In the *olitorius* varietal trial, JRO-514, JRO-753, JRO-632 and JRO-452 proved significantly superior to C.G. at 1% level yielding about 32, 30, 28 and 28 per cent higher respectively.

41 simple varietal trials (subvention trials), 35 *capsularis* and 6 *olitorius*, were successfully conducted in cultivators' plots in the different States. The yield data of the trials conducted in West Bengal were analysed. No significant difference in yield was observed among the four improved types viz. JRC-212, D154, JRC-5854 and JRC-321.

Four *olitorius* intervarietal hybrids, two in F_4 and two in F_5 were grown. Bulk seeds of about 1000 best plants per cross were carried forward under the "Modified Mass Method" for further tests next season. The interspecific cross between *C. olitorius* and *C. capsularis* was followed up.

Some colchicine induced polyploids of *C. capsularis* and *C. olitorius* were grown for maintenance. 94 strains, 75 of *C. capsularis* and 19 of *C. olitorius*, were grown for maintaining the stock of germ plasm.

Soft or weak wood appeared to be a major factor in lodging of the cultivated varieties of *C. olitorius*.

Collection of jute varieties and types

Six exotic samples of jute seeds, three *olitorius* from Russia, one *capsularis* and one *olitorius* from Bangkok and one *olitorius* from Portugal were received. The *olitorius* seeds received from Russia did not germinate. The other materials from Bangkok and Portugal were sown in small observation plots, and thirteen selections, 8 of *olitorius* and 5 of *capsularis* were made.

Breeding

Nursery test

95 *capsularis* selections including selections from hybrid materials and local types were raised in a nursery with five standard types as

controls. But due to poor stand in many plots, proper assessment of the materials in respect of plant height, basal diameter, maturity etc. could not be made on a sample basis. 190 selections were, however, made for further studies.

Microplot tests

Four *capsularis* microplot tests ('A' trials) in lattice design with four replications were conducted to test the yield performance of a number of new types carried forward from the preceding year. Each trial had 25 types including four standard ones viz. JRC-212, JRC-321, D154 and JRC-919 as controls.

In the trial No. 1, there was no significant difference between the types in respect of yield.

In the trial No. 2, JRC-919, the very late type and the hybrid types JRC-7045, JRC-7027, JRC-7019 and JRC-10011 proved significantly superior to D154 at 5% level, yielding about 57, 51, 50, 40 and 34 per cent higher respectively than D154; JRC-919, JRC-7045 and JRC-7027 yielded about 10, 6 and 5 per cent higher respectively than JRC-212, but all of them were in the same critical group.

In the trial No. 3, two new hybrid types JRC-7174 and JRC-10041 yielded about 17 and 15 per cent higher respectively than D154 and about 10 and 8 per cent higher respectively than JRC-212 though all of them were in the same critical group.

In the trial No. 4, types JRC-25, JRC-7, JRC-104, JRC-110, JRC-14, JRC-90, JRC-106, JRC-111, JRC-85, JRC-117 and JRC-17, yielded about 20, 20, 18, 18, 13, 12, 12, 12, 11, 8 and 5 per cent higher respectively than D154 with which they were in the same critical group, whereas types JRC-25, JRC-7, JRC-104, JRC-110 and JRC-14 yielded about 10, 10, 12, 12 and 16 per cent less than JRC-212 with which they were in the same critical group.

Varietal trials

(i) One *capsularis* varietal trial was conducted with ten types viz. EC-4142 (evolved at Pusa), JRC-206, JRC-9527, JRC-6382, JRC-8429, JRC-147, JRC-6291, JRC-211, D154 (control) and JRC-212 (control).

The results of analysis of the yield data along with the dates of first flowering of the types which gave higher yield over the control are given below :—

TABLE—I

Capsularis varietal trial

Layout—Randomized blocks in 6 replications.

Gross plot—1/109 acre approx. (25' × 16')

Effective plot—1/135 acre approx. (23' × 14')

Date of sowing—6.5.1961.

Harvested on 25.9.1961, 27.9.1961 and 10.11.1961
at the small pod stage.

Variety	Mean yield (q/ha)	Percent on control (D154=100)	Date of First flowering	Quality* Index (gm/tex)	Weight* C.V.%
JRC-206	29.2	113.7	10.10.61	13.2	23
EC-4142	29.1	113.2	10.10.61	12.7	25
JRC-6382	28.5	111.0	17.8.61	13.0	21
JRC-212	27.5	107.0	17.8.61	12.9	25
JRC-8429	26.7	103.8	17.8.61	13.2	21
JRC-211	26.1	101.7	17.8.61	13.3	21
D154	25.7	100.0	17.8.61	13.0	21

C.D. (5%) = 2.7

C.D. (1%) = 3.7

* Results of quality test relate to 1960-61 trial, as results of the same test for 1961-62 trial have not been received as yet.

JRC-206, EC-4142 and JRC-6382 proved significantly superior to D154 at 5% level, yielding about 14, 13 and 11 per cent higher respectively. JRC-206, EC-4142 and JRC-6382 also yielded about 6, 6 and 4 per cent higher respectively than JRC-212 but they were in the same critical group.

JRC-212 yielded about 7 per cent higher than D154 but the difference was not significant.

(ii) An *olitorius* varietal trial was carried out with eight types with C.G. as control.

JRO-632 gave the highest yield of 26.3 q/ha and was significantly superior to all other varieties at 1% level. JRO-514, an X-ray derivative of JRO-632, gave 23.3 q/ha but was in the same critical group. The latter has now to be tested under different environmental conditions.

The trial, however, will be repeated next season, as it was adversely affected by heavy incidence of root-rot, resulting in high mortality of plants in the different types.

(iii) *Combined trial of capsularis and olitorius improved types.*—The types tried were two *olitorius* viz. JRO-632 and JRO-514 and three *capsularis* viz. JRC-206, JRC-212 and D154 (control).

The results of analysis of the yield data along with the dates of first flowering of the different types are given below :—

TABLE—II

Combined trial of capsularis and olitorius improved types

Layout—5 × 5 Latin square

Gross plot—1/50 acre approx. (35' × 25')

Effective plot—1/57 acre approx. (33' × 23')

Date of sowing— 5.5.1961

Harvested on 23.9.1961.

Variety	Mean yield (q/ha)	Percent on control D154-100	Date of 1st flowering	Remarks
JRO-514	27.7	140.5	3.9.61	Results of quality test have not been received as yet. The trial was carried out for the first time during the year under report.
JRO-632	26.8	135.8	2.9.61	
D154	19.7	100.0	31.8.61	
JRC-212	19.2	97.3	7.9.61	
JRC-206	17.6	89.4	Harvested at the pre-bud stage	

C.D. (5%) = 2.1

C.D. (1%) = 3.0

Simple varietal trials (subvention trials) in cultivators' plots

28 *capsularis* simple varietal trials in large plots (1/30 acre) were planned to be conducted in cultivators' plots of the different jute growing States, five each in West Bengal, Bihar, Assam, Orissa and U.P. and three in Tripura. Five *capsularis* types were included in these trials viz. JRC-212, JRC-6382, JRC-9527, JRC-206 and D154 for comparative tests of yield and quality of fibre.

Out of the planned 28 trials, only 26 were sown, of which, 6 failed. Yield data from 16 trials only have been received so far from the different States and the analysis of the yield data is in progress.

Results of the trials conducted in Bihar, Orissa and U.P. during 1960-61

Bihar

3 *capsularis* and 2 *olitorius* trials were successfully conducted. The data were, however, inadequate for statistical analysis.

Orissa

7 *capsularis* trials were conducted successfully. Varietal differences in yield were not significant. Mean yield of the varieties is given below :

TABLE—III

Capsularis simple varietal trials in Orissa, 1960-61.

Variety			Mean yield (q/ha)
D154	...	...	18.3
JRC-212	...	...	17.5
JRC-5854	...	...	17.0
JRC-321	...	...	16.2
Local	...	...	15.8

Uttar Pradesh

8 *capsularis* and 4 *olitorius* trials were conducted successfully. The analysis of the yield data is given below :

TABLE—IV

Capsularis simple varietal trials in U.P. 1960-61

Variety			Mean yield (q/ha)
JRC-5854	...	...	22.5
JRC-212	...	...	21.3
JRC-321	...	...	19.5
D154	...	...	19.1
Local	...	...	18.6

C.D. (5%) = 1.9

C.D. (1%) = 2.6

It may be seen from the table above that JRC-5854 and JRC-212 are significantly superior to D154 at 5% level.

TABLE—V

Olitorius simple varietal trials in U.P. 1960-61

Variety			Mean yield (q/ha)
JRO-753	...	...	13.4
JRO-620	...	...	11.6
JRO-632	...	...	11.5
C.G.	...	...	10.1

Varietal differences in yield are not significant. The degrees of freedom for error is rather low, being only 9.

Hybridization

Intervarietal

The following *olitorius* intervarietal hybrids were grown in separate nurseries along with their parents for selection under the "Modified Mass Method".

- (a) 1. JRO-632 $\times$ OT-1507 (Russian Green) in F_5
2. JRO-632 $\times$ OT-1506 (Russian Red) in F_5

In all, 1000 selections, 500 of each, were made in the hybrid populations of the above two crosses. Later, there was high mortality due to incidence of root and stem-rot and only 705 selections survived. Of these, 217 promising selections were reselected on the basis of plant height, basal diameter, maturity etc. for further studies.

- (b) 1. Sudan Green $\times$ JRO-632 in F_4
2. Sudan Green $\times$ JRO-620 in F_4

1000 promising plants each from the above crosses were selected. The Seeds from five healthy pods per selected plant were collected and bulked separately for the two crosses, for further studies.

Interspecific

The F_2 population of the interspecific hybrid *C. olitorius* $\times$ *C. capsularis* was severely affected by diseases and pests and very few plants survived. Seeds from the surviving plants were collected for further studies.

Lodging in *C. olitorius*

Lodging is a problem in the cultivated varieties of *C. olitorius*. The lodged plants sometimes break affecting their growth and fibre yield.

Further selections, including both erect and lodged plants, from the F_5 single plant progenies of the crosses between JRO-632 $\times$ OT-1507 and between JRO-632 $\times$ OT-1506, were made and the seeds collected for further studies.

Histological studies revealed that the proportion of parenchymatous cells in a lodged plant was much more than in a normal plant, resulting in softness or weakness of the wood. Soft or weak wood appeared to be a major factor in lodging of *olitorius* jute.

Studies on the factors influencing fibre yield in Jute

From a trial laid out in randomized block design with 14 replications, it was found that JRO-632 proved significantly superior to C.G. in respect of plant height and fibre/wood ratio, though there was no significant difference between their basal diameters. JRO-632 proved significantly superior to C.G. in fibre yield also, which may then be attributed mainly to the greater height and higher fibre/wood ratio of the former. Fibre/wood ratio is therefore a very important factor in determining fibre yield in jute and should be used as a third criterion for selection besides plant height and basal diameter, especially during the early stages of jute breeding.

Breeding *olitorius* Jute for early sowing in early rainfall areas and in irrigated lands.

The *olitorius* types, including the improved types, flower early and plants become bushy, when sown earlier than the middle of April, due to the photoperiodic effects.

In order to overcome this, a crossing programme with JRO-632 and a selection from an exotic type as parents was undertaken. From such a cross, selections have been made, which may be sown as earlier, without early flowering. These are being carried forward to study this behaviour in the subsequent generations.

Genetics of Jute

Polyploidy

A few colchicine induced polyploid materials both of *C. capsularis* and *C. olitorius* were grown. Two plants were selected from each culture for maintenance of the polyploid lines.

Genetic strains

Progenies of 89 strains, 70 of *C. capsularis* and 19 of *C. olitorius*, were raised. After careful checking in respect of pigmentation, branching habit, plant height, maturity, etc. seeds of about 6 plants per progeny were collected for maintenance.

In addition, 5 other wild species of *Corchorus* viz. *C. aestuans*, *C. fascicularis*, *C. tridens*, *C. trilocularis* and *C. siliquosus* were also grown and seeds from single plants were collected, for maintenance of the species.

Inheritance of a new anthocyanin pigmentation pattern in *C. olitorius*

The new anthocyanin pigmentation pattern in *C. olitorius* is characterised by a red dot at the base of the stipule and absence of pigment on all other parts of the plant. This expression of anthocyanin pigment is the minimal level in *C. olitorius*.

I. (b) Allied Fibres

Short summary of work done last year.— Five progeny row trials, 2 of *Hibiscus cannabinus* and 3 of *H. sabdariffa*, were carried out. In *H. cannabinus* first year trial, no culture was found superior to the standard strain. In the 3rd year family block trial, however, all the 5 families gave higher yield of fibre, 4 of them being significantly superior to the control. In *H. sabdariffa* first year trial, 5 progenies were found to be significantly superior to the control—R.T. 1, in yield. In the second year trial of *H. sabdariffa*, 3 of the 5 families gave higher yield, but were not significantly superior to the control—R.T. 1. In the third year roselle family block trial, all the 5 families gave higher yield over the control, 4 being significantly superior.

In mesta (*H. cannabinus*) varietal trial, the strains H. C. 583 and H. C. 584 gave higher yield, though not significant, over the control, M. T. 15.

The F_1 , F_2 and back cross progenies of the original reciprocal crosses between bristle and non-bristle strains in *H. sabdariffa*, were grown. Morphological records and segregation counts were maintained.

Type collection—During the period under report, a total collection of 93—4 indigenous and 89 exotic-types were made. Of the exotic types, one was received from U.S.S.R. and the rest from the U.S.A. Besides different types of *Hibiscus cannabinus* and *H. sabdariffa*, the collected materials included a few other species of *Hibiscus*, e.g. *ficulneus*, *surattensis*, *radiatus*, *furcellatus*, *acetosella*, *esculentus*, etc. and also *Cannabis sativa*, *Asclepias syriaca* and *Sansevieria* sp. Only one specimen received earlier from U.S.S.R., was sown and the type survived well under local conditions. This will be further tested along with the other types received late.

Breeding

Hibiscus cannabinus.—One varietal trial with 4 selected strains and one standard strain, was carried out at the Jute Agricultural Research Institute Farm, Nilganj, as per details given in table VI.

TABLE—VI

Mesta Varietal Trial

Layout—5 × 5 latin square design.

Gross plot size—20' × 14'

Effective plot size—18' × 12'

Date of sowing—29.5.61.

Strains	Yield q/ha.	Percent on control	Date of Harvest	Quality index in gm/tex.*	Weight C. V. % *	
H. C. 583	14.0	149	27. 10. 61	10.7	19	
H. C. 867	13.5	144	27. 10. 61	11.4	26	*Report of fibre sample of previous year.
H. C. 584	13.3	142	27. 10. 61	10.3	17	
H. C. 269	11.7	124	27. 10. 61	12.3	22	
M. T. 15 (control)	9.4	100	10. 10. 61	13.9	19	

P = 0.01

C.D. = 3.1 q/ha

S.E. = 0.7 q/ha

It can be seen from table VI that the selected strains H. C. 583, H. C. 867 and H. C. 584 are significantly superior to control M. T. 15, at 1% level, giving about 49%, 44% and 42% higher yield respectively. The other selected strain H. C. 269 though in the same critical group as the control, yielded about 24% higher.

One mesta varietal trial with 3 improved strains, M. T. 129(L.L.), M. T. 150 (E.L.) and M. T. 102 (L.L.) and one control, a local type, was conducted at the Jute Research Substation, Katihar, Bihar. The yield and other necessary data were not received for analysis at the time of writing the report.

Of the 5 mesta varietal trials conducted in cultivators' plots in U.P., only 3 were successful, one each at Bahraich, Tamkahi Road and Gograghat. The yield data are under analysis. The strains included in those trials were M. T. 129(L.L.), M. T. 150(E.L.), M. T. 166(L.L.) and one local type of the respective areas, as controls.

Hibiscus sabdariffa

Progeny test.—One second year progeny row trial with 40 progenies, including 5 progenies of the control, was carried out. But the trial failed due to heavy incidence of stem—and foot-rot ; seeds from disease-free plants were collected for trial during the next season.

Microplot tests.—One microplot trial with 10 cultures including two controls, R.T. 1 and R.T. 2., was conducted at Jute Agricultural Research Institute Farm. Promising cultures were carried forward for further tests.

Varietal trials.—Three Roselle varietal trials No. 1, 2 and 3, were conducted at the central station. Details of analysed data of trial No. 1 and 2 are given in table VII and VIII respectively.

TABLE—VII

Roselle Varietal Trial No. 1

Layout—5 × 5 latin square design

Gross plot size—25' × 22'

Effective plot size—23' × 20'

Date of sowing—31.5.62

Date of harvest—Between 27.11.61 and 29.11.61.

Strains	Yield q/ha	Percent on control	Quality index gm/tex.*	Weight C. V. %*	
N. P. Sab 5	17.78	119	9.6	26	*Report of fibres of previous year.
R. T. 26	15.91	101	9.6	24	
R. T. 1 (control)	15.81	100	8.6	27	
R. T. 2	15.62	99	8.9	26	
R. T. 1 N. B.	15.15	96	7.4	29	

P = 0.01

C.D. = 1.5 q/ha

S.E. = 0.39 q/ha

It is seen from table VII that the strain N.P. sab 5 gave significantly higher yield at 1% level, while the rest of strains belong to the same critical group as the control R. T. 1. The improved strain, R. T. 2, usually yielding higher than the control, R. T. 1, also belonged to the same critical group. The yield data of this trial for the last 3 years are under serial analysis, to evaluate the comparative merits of the strains.

TABLE—VIII

Roselle Varietal Trial No. < 2

Layout—5 × 5 latin square design.

Gross plot size—24' × 22'

Effective plot size—22' × 20'

Date of sowing—29.5.61

Date of harvest—29.11.61

Strains	Yield q/ha	Percent on control
H.S. 4281	18.8	128
H.S. 4288	18.2	123
H.S. 4282	18.0	122
H.S. 4278	17.8	121
R.T. 2 (control)	14.7	100

P = 0.01

C.D. = 1.7 q/ha

S.E. = 0.4 q/ha

From table VIII it can be seen that all the 4 selected types i.e. H. S. 4281, H. S. 4288, H. S. 4282 and H. S. 4278 were significantly superior to the control R. T. 2, at 1% level, giving about 28, 23, 22 and 21 per cent higher yield respectively.

Analysis of yield data of the roselle varietal trial No. 3, did not show any significant difference among the various strains, probably due to the unequal growth of the plants. The trial will be repeated during the following season.

Another roselle varietal trial was conducted at Jute Research Substation, Katihar, Bihar, with 4 improved strains, R. T. 1, R. T. 1 (N.B.), R. T. 2, and R. T. 26 and one local type as control.

Hybridization

Intervarietal—Roselle (*Hibiscus sabdariffa*)

(i) *Non-bristle × bristle characters*.—The F_1 , F_2 and F_3 progenies of the reciprocal crosses between R. T. 1 (non-bristle) and R. T. 2, were grown in lines along with progenies of the back crosses between F_1 and the

two parents. Morphological records and segregation counts were made. Seeds were collected from the selected plants for further observations in F_4 generation.

(ii) *Early flowering* $\times$ *Late flowering*.—The F_1 progenies of the crosses between 'intermedius' $\times$ R. T. 2, were sown in lines. The former normally flowers about a fortnight earlier than the latter. But the F_1 progeny did not show any earliness in maturity. Seeds were collected to observe the F_2 generation.

Minor Fibre Crops

Six different minor fibre crops were included in yield trials, to test their comparative efficiency so far as yield and quality of fibres are concerned. Analysed data are given in table IX.

TABLE—IX

Comparative yield trial with miscellaneous fibre crops

Layout— 6×6 latin square design.

Gross plot size— $15' \times 12'$

Effective plot size— $15' \times 10'$

Date of sowing—18.5.61.

Name of species	Yield q/ha	Date of harvest
<i>Urena sinuata</i>	18.5	5.12.61
<i>Sida rhombifolia</i>	10.5	14.11.61
<i>Malachra capitata</i>	8.5	18.9.61
<i>Hibiscus panduraeformis</i>	6.6	14.11.61
<i>Abutilon indicum</i>	5.6	18.9.61
<i>Urena lobata</i>	3.4	8.9.61

P = 0.01

C.D. = 3.2 q/ha

S.E. = 0.8 q/ha

From table IX it can be seen that the results were significant at 1% level.

Genetic strains

Hibiscus cannabinus.—In all, 18 different strains were maintained. Morphological characters were checked, plants selected and selfed and seeds were collected.

H. sabdariffa.—In all, 14 different strains were grown. Pigmentation and other phenotypic characters were checked. Seeds were collected from selected plants.

Crotalaria juncea.—All 6 improved strains, including K-12 were grown and seeds were collected from selected plants.

Boehmeria nivea.—Plantation was maintained in about 0.5 acre of land.

Minor fibre crops.—A few other bast fibre crops e.g. *Urena sinuata*, *U. lobata*, *Malachra capitata*, *Hibiscus panduraeformis*, *Sida rhombifolia*, *Abutilon indicum*, *Abroma augusta*, *Helicteris isora* and *Thespesia lampas* were maintained.

Agave.—Four species of *Agave*, i.e. *sisalana*, *cantala*, *veracruz* and *wightii* were maintained.

Furcraea sp.—One species, *F. gigantia* was maintained.

I.(c) Unit : Cytogenetics

Short summary of work done last year.—In the X_3 generation of X-ray irradiated materials, segregation was observed in seedling characters and time of maturity in *C. olitorius* (JRO-632) and pigmentation in *C. capsularis* (JRC-212), whereas pigmentation variants with non-branching habit and earliness in *capsularis* (JRC-919) bred true. New leaf variants e.g. 'dry wrinkled leaf', 'irregular lamina' and 'albino blotched' appeared in some treatments (40,000r to 70,000r) of JRC-212 and JRC-919. Selfed seeds from the desirable variants e.g. 'Non-branching-early' of JRC-919,

'stunted tobacco leaf', 'ornamental leaf', 'non-shattering pod' of JRO-632 and single plant selections from root-rot resistant types (JRO-632) and drought resistant types (JRC-919 and JRC-212) were carried forward for study in the X_4 generation. A haploid plant of JRO-632 was isolated from 70,000r treatment. Morphological variants were not found in the chronic gamma-ray-irradiated materials of JRC-212 and JRO-632, except a 'blotched yellow' leaf type. Single plant selections in the G_1 generation made on the basis of physiological characters (vigour, early flowering etc.), were carried forward. From fresh chronic exposures of gamma-rays dosages of 1000r to 10,000r, on JRO-632, wild olitorius, JRC-919 and small pod (X-ray induced variant of capsularis), collections were made from labelled pods and carried forward. Acute gamma-ray treatments of 40,000r to 200,000r in JRC-212 and JRO-632 gave rise to morphological variants (affecting all parts of the plant) and physiological variants. No germination was observed beyond 140,000r. Mutation rate was higher in *C. olitorius*. Single plant selections were carried forward. A comparative study of the leaf contents of leaf variants (induced by X-rays and gamma-rays) and the mother strains revealed a changed pattern in the variants with regard to a number of free amino-acids. Out of colchicine-induced selected tetraploids of JRC-212 and JRO-632 in C_3 , triploids (with narrow leaf, comparatively small flower, 68% pollen sterility and 21 chromosomes) were isolated. Seed setting in $3n$ was very poor. F_2 progenies of inter specific crosses of JRO-632 and JRC-212 with *C. aestuans* as female parent and F_2 progenies of intervarietal crosses at tetraploid $\times$ diploid level ($4n$ *C. G.* $\times$ $2n$ JRO-632) and ($4n$ D154 $\times$ $2n$ JRC-212) were studied for segregation and selections were carried forward.

X-ray materials

All selections from the following desirable variants bred true in the X_4 generation, except the 'ornamental leaf' variant, where 3% of the total selections gave only normal types morphologically similar to mother strain (JRO-632).

(a) The thick cylindrical stem with long internodes of 'ornamental leaf' variant yielded 9% more fibre per plant when compared to mother

strain. The number of ultimate fibre cells per fibre bundle in the bark was 25.7 on an average, as against 22.37 in JRO-632.

(b) The leaves of the stunted 'tobacco leaf' variant of JRO-632 were found to be more resistant to semilooper attack. Initial phase of growth of the variant was very slow. The large leaves were covered on the lower surface and on the veins and veinlets of the upper surface and margin of the lamina, with multicellular dumbell shaped hairs. Such hairs were distributed mainly on the margin and scantily on the upper and lower surface of lamina of the mother strain (JRO-632).

(c) The 'non-branching' pigmentation variants in JRC-919, from the progenies of 30,000r and 40,000r treatments in general yielded 7% more fibre. The yield of fibre in the early maturing types from the 80,000r and 90,000r treatment (earlier by 30 days over the control JRC-919), was the same as in the control.

Selfed seeds and seeds collected after crossing with mother strains were carried forward to study fibre yield and segregation respectively, in X_5 generation.

(d) More plants, not affected by root-rot, were found in the X_4 generation of the types selected for disease resistance from the 30,000r, 40,000r and 80,000r treated progenies. But there were no differences in the fibre yield and time of maturity in the selected types, when compared with the mother strain (JRO-632).

A 'large pod' variant was isolated from X_4 generation, from a progeny of 30,000r treatment where the pod breadth was 2 to 4 times the normal having 7 to 23 chambers, with number of seeds varying from 27 to 412 per pod. Single plant selections from these pod variants were carried forward. Disease free and vigorous single plant-selections were carried forward for the study of their behaviour in X_5 .

(e) Seeds from progenies selected for drought resistance from JRC-212 and JRC-919 of 30,000r to 100,000r treatments grown at Gograghat, U.P., were carried forward for further studies in X_5 . Some

progenies of JRC-919 belonging to 40,000r and 70,000r treatments were found to be early maturing types (23 days earlier over the control).

(f) Seeds from a few selected progenies of JRO-632 belonging to 20,000r, 40,000r and 70,000r treatments, with 'non shattering pods' having normal shape have been carried forward. Selections of 'non shattering' pod-types from "tobacco leaf" and small plant with 'short internode' (50,000r) and 'crumpled leaf' (90,000r) were crossed with the mother strain and seeds carried forward.

(g) The following segregating types with their normal heterozygous types were selected and carried forward for cytogenetical studies.

(i) A 'deep red' stem variant of JRO-632 arising out of 40,000r treatment has been isolated in the X_4 generation from apparently normal, green progeny.

(ii) A leaf variant of JRC-212 with 'upfolded lamina' isolated at X_3 from 50,000r treatment, on anatomical observation revealed the presence of 'soft stem' at X_4 . Lignified fibre cells were absent in the bark and wood in the secondary growth zone. In the primary phloem and xylem developed from procambium, normal lignified fibre cells were found, but in the secondary phloem and wood, these cells were replaced by prosenchymatous cells with cellulose walls.

(iii) A 'bushy top' variant of JRC-212 arising out of 100,000r treatment was characterised by the presence of terminal cluster of flowers and pods. The variant was further characterised by absence of branches below the terminal culster of inflorescence ; however, small branches, each terminated by a cluster of flowers and subsequently pods, developed later from the terminal clusters.

Morphological and cytological studies revealed the presence of following sterility types among X-ray variants.

(iv) 'Crumpled, irregular lamina' in JRO-632 arising out of 90,000r treatment was found to be totally sterile.

(v) 'Starry leaf' variants of JRC-212 arising out of 70,000r treatment were female sterile. Due to meiotic irregularities e.g. early separation and non-disjunction of bivalents during first division of meiosis in P.M.Cs, microspores with 5, 6, 8, 9 and 10 chromosomes were found, besides the normal 7 chromosomes.'

(vi) 'Ribbon leaf' variants of JRC-212 arising out of 40,000r treatment were male sterile. Microsporogenous cells were not found in the staminodes. Megasporogenesis was normal.

Gamma ray materials

(a) Bulk seeds from selections of JRO-632 showing variations in physiological characters from G_1 and G_2 generations (i.e. the vigorous and early maturing types) were carried forward for yield study in replicated randomized plots. Total population in each treatment group (varying from 1000r to 10,000r) of chronic gamma ray-irradiation has been fairly uniform for the characters for which they were selected.

(b) Other materials e.g. JRC-212 (at G_2) and wild *olitorius*, JRC-919 and 'small pod' (*capsularis*, X-ray variant) at G_1 , where no prominent morphological variability was induced, except the stunted and late flowering types, individual plant selections were carried forward for further studies.

(c) A new pigmentation pattern in JRC-212, arising out of acute irradiation of gamma ray of 36,000r, on histological investigation revealed the presence of anthocyanin in the entire cortical parenchyma and extending up to cambium through phloem parenchyma and phloem ray cells. Pigmentation in *capsularis* is usually due to the presence of anthocyanin-containing cells in the epidermis. The variant was backcrossed with mother strain and seeds were carried forward for study in G_3 .

Selections made on the basis of vigour and late maturity in JRO-632, arising out of acute gamma ray irradiation of 40,000r were crossed with the mother strain. The selections in average were 91 cms taller

with almost similar basal diameter and 7 to 15 days late in flowering when compared to the mother strain (JRO-632).

Morphological variations e.g. folding and curling of lamina, deep serration of lamina, fasciation of stem, (in JRO-632 at 40,000r) and hard stem (in JRC-212 at 36,000r) were carried forward for maintenance. One variant 'deep serrated, irregular lamina' (JRO-632, 40,000r) was found to be female sterile. Microsporogenesis was normal, but ovules degenerated after binucleate or tetranucleate embryo-sac stage.

Colchicine treatments

Selected tetraploids of JRC-212, JRC-919 and JRO-632 in C_3 generation generally had short thick hard stem, with short internode and late flowering. Tetraploids of 0.1% colchicine/6 hours treatment series had, however, early flowering progenies in JRC-919 and JRO-632. Selfed seeds from these progenies were carried forward.

Interspecific hybridization

The F_2 progenies of the following crosses of scions after reciprocal grafting : *C. aestuans* $\times$ JRC-212 and *C. aestuans* $\times$ JRO-632, are all uniform in character resembling the female parent *C. aestuans*. The materials were rejected.

Intervarietal hybridization

47% of the F_3 plants of the tetraploid $\times$ diploid intervarietal crosses resemble the female tetraploid parent 4n C. G., in 4n C. G. $\times$ 2n JRO-632 crosses. Pollen sterility in the plants is 38.3% with pollen size varying from 41.2μ to 53.0μ . A new type with very slender stem and round leaf having deep thread-like serrations, appeared in 3% of the total F_3 population. These plants were highly sterile, with 83.9% pollen sterility. Meiotic study revealed the presence of tetravalents, bivalents and univalent chromosomes in the P.M.C.s.

In the F_3 progeny of 4n D154 $\times$ 2n JRC-212 cross, all the plants resembled the tetraploid female parent,

Selections from the different progenies were carried forward.

I. (d) Anatomy

Short summary of work done last year.— *Histological studies of the leaf variants (from JRC-212 and JRO-632 X-ray materials) revealed xerophytic nature. Abnormal stomata with one guard cell and lack of stomatal aperture was found in these leaf variants. Fibre content in the stem variants of JRC-212 (thick hard stem with long internode), JRO-632 (thick cylindrical stem) was found to be comparatively high, with increased length/breadth ratio of ultimate fibre cells, by 12%. New anatomical features as compared to the mother strain e.g. one layer of stone cells lining the ovarian chamber, sclerenchymatous cap on the vascular bundles of the dorsal suture and scanty mucilage canal in the mesocarp, were found in the non-shattering pod variant 'stumpy pod'. The pods of haploid plants, were anatomically similar, with no mucilage canal in the thin walled very large cells of mesocarp tissue. Most of the ovarian chambers were empty or with degenerated ovules. Few ovules were found with functional eight nucleate embryo sac. Most of the ovules degenerated at the four nucleate stage of embryo sac. Comparative study of fibre content and ultimate fibre dimensions in 36 selections of capsularis varietal trial (of Plant Breeding Unit) revealed increase of fibre content (4%) per unit area of bark, but no improvement of length/breadth ratio of ultimate fibre cells over the standard type JRC-212. F_2 plants from $4n$ C. G. $\times$ $2n$ JRO-632 were marked by thick leaves, due to extended mesophyll tissue with closely packed palisade cells. The stomata were larger than the diploid strain, with higher frequency. The sterile leaf variants had thin, round lamina with deep serrations. Microscopic study of long bast fibre cells of ramie, sunn hemp, *Asclepias* sp. and *Calotropis* sp. revealed characteristic distinguishing features e.g. transverse folds in ramie. Obliquely longitudinal fissures on the wall were longer in ramie and *Calotropis* than in *Asclepias* and Sunn hemp. The lumen was comparatively wide and uniform in *Asclepias* and *Calotropis*.*

Anatomical studies of X-ray and Gamma ray induced variants

(a) Bast fibre content analysis in 'ornamental leaf' variant of JRO-632 revealed the presence of 9% more fibre bundles per unit area of the bark,

when compared with the mother strain. The ultimate fibres were narrow, with 25.7 cells per bundle in average as against 22.4 in JRO-632. The length/breadth ratio of ultimate fibre cells was 162 while in JRO-632 it was 159. In the 'tobacco leaf variant', fibre content per unit area of bark was same as that in the mother strain. Length/breadth ratio of ultimate fibre cells was 151.

(b) Histological study of the "Tobacco leaf" variant revealed that tannin containing cells were more frequent in the cortex, phloem ray and secondary phloem zone in the extra-xylary portion. Druses (clustered crystals of calcium oxalate) were also found to be more frequent in the secondary phloem zone and tangentially elongated (in transverse sections) hypodermal cells of the variant.

(c) The cyto-histological pattern of the shoot apex of the X-ray-variant 'disrupted phyllotaxy' when compared with mother strain JRC-919 was same with regard to the number of layers, extent and orientation of the tunica and corpus zones. During morphogenesis, evidences of appearance of two leaf primordia, initiated simultaneously from tunica-2 layers and having common foliar foundation have been noted. Successive appearance of the primordia at the shoot apex, did not follow the typical left handed helix of normal JRC-212.

(d) Developmental studies of the 'double capsule' variant of JRC-212 revealed that during the histogenesis of the gynaecium, the central column of the syncarpous ovary developed into a hollow one chambered or three chambered structure. The ventral vascular traces which supplied vascular strands to the ovules, also supplied branch traces to the one or three placental structures of the inner chamber, from which ovules developed. The inner chamber was gradually filled up by the growth of the placental structure. Most of the ovules of the inner chamber degenerated. A few viable seeds were, however, found in some of the progenies.

(e) Morphological study of the 'whorled leaf' variant of JRC-212 revealed the rhythmic suppression of elongation of two successive internodes followed by the elongation of the third internode giving rise to whorled phyllotaxy of the variant with three leaves at each visible node.

Nodal anatomical study revealed the successive divergence of leaf traces of three nodes in the typical angular deflection of the left handed helix, only telescoped due to suppression of the two internodes. After spraying of gibberellic acid (100 ppm) at the shoot apex for 16 days, the young nodes were found to be vertically extended (due to elongation of the suppressed internodes) with the three leaves obliquely separated, but connected by ribbing of the petiole base, each leaf having one extra axillary and one hypoaxillary stipule situated on the ribs.

Anatomical peculiarities due to injury of nematode attack in the roots of *C. capsularis* and *C. olitorius*.

(a) Injury due to nematode attack was mainly restricted to extra-xylary tissues. Wood portion was also affected in case of attack initiated in earlier stages of the crop. Radial perforations passing through the extra-xylary portion while entering the wood had diverted either morphologically downwards or upwards, bursting the xylem vessels and clogging the lumen of the trachial cells. In the extra-xylary portion, as a result of injury due to perforations, secondary development took place due to the activity of cambium strips formed from the parenchymatous cells surrounding the injury. Contributions of these cambial strips differed in different zones. In the epidermal zone, the cambium acted as phellogen, contributing scanty phellum centrifugally as compared to phelloderm formed centripetally, giving rise to small superficial warty outgrowths. In the cortical zone, the empty perforations were usually filled in by very thin walled, irregularly arranged parenchymatous cells, formed from the surrounding cambium. In the phloem and phloem-ray zone, the empty injured portion was filled in by thin walled or thick walled (large cells with inter cellular spaces) parenchymatous cells and not infrequently by a hadrocentric vascular strand, formed in continuation with the phloem zone. In the injured woody portion, either thin walled parenchymatous cells (without intercellular space) or xylem tissue was formed. But the orientation of the cells of these vascular tissue was parallel to the axis of injury i.e., transverse or oblique to the longitudinal axis of the wood. Besides these, strips of cambium also formed in the parenchymatous cells (mostly in the cortex) away from the zone of injury,

due to stimulation by the injury. Centrifugal growth of parenchymatous or vascular tissue took place from these strips. Sclerenchymatous cells were never formed from the injury-cambium.

II. SECTION OF AGRONOMY AND PLANT PHYSIOLOGY

II.(a) UNIT : AGRONOMY

Short summary of work done last year.—In the trial “Time of application of N on the yield of Jute Fibre”, it was observed that the effect due to time of application of nitrogen on yield was significant, but differences due to source of N and interactions were not significant. Application of nitrogen in 3 splits—1/3 at sowing, 1/3 at 3 weeks crop age and the remaining 1/3 at 6 weeks crop age gave the highest yield of fibre. Application made in 1 dose either at 3 weeks or at 6 weeks crop age gave significantly lower yields. In studies with new fertilizer mixtures, Nitrophoska (blue), Nitrophoska (green), or Complezol did not show any advantage over ammonium sulphate alone, both in capsularis and olitorius jute under Nilganj conditions. In ‘variety-cum-manure-cum-sowing practices’, the effects due to variety, manure and interaction between manure and sowing practices were significant. Among the varieties, JRC-212 gave highest average yield and was superior to D154 or local ; as regards manurial levels, 89.7 kg. N/ha together with PK proved superior to 44.8 kg. N/ha plus PK, which again proved superior to control i.e. ‘without nitrogen’. In ‘Maximum potential studies on manuring’ with capsularis at Kendrapara, the yield of jute increased with increasing levels of N up to 89.7 kg. N/ha ; presence of PK with Nitrogen tended to give slightly increased yield. At Sorbhog, timely interculture could not be given due to continuous rain, moreover, the crop was badly damaged by diseases and pests and as such conclusive results could not be obtained. Results of ‘Simple manurial trials’ conducted in cultivators’ fields in the five jute growing States of West Bengal, Bihar, Assam, Orissa and U.P. for seven years, have shown that the responses were significant at 1% level in West Bengal (24 Parganas) and Bihar (Purnea, Saharsa and Champaran), at 5% level in Assam (Nowgong, Goalpara and Kamrup), Orissa (Cuttack) and U.P. (Deoria, Lakhimpur-kheri, Azamgarh and Ballia). In most of the places, application of NPK yielded highest quantity of fibre.

With regard to intercultural operations, one hand weeding in addition to 4 wheel hoeings gave sufficiently high yield (21.2 q/ha). Yield was highest with 2 hand weedings plus 4 wheel hoeings. Use of scrapers and tines with a view to replace hand weedings, has given encouraging results, particularly with *capsularis* jute. In *olitorius* jute, a combination of wheel hoeing, scraping and hand thinning gave an yield of 23.6 q/ha while hoeing and scraping alone gave 22.4 q/ha.

At Sorbhog (Assam), highest yields were obtained from crop sown on 1st March both in *capsularis* and *olitorius* jute, as against crops sown later. At Kendrapara (Orissa), the sowings by the end of March gave better results.

In a triple cropping cycle with jute-paddy and pulse under Nilganj conditions, jute sown at the end of April and harvested at 105 days and paddy sown earliest between 16th and 31st August, seemed to give optimum results. Paddy preceded by jute gave better yield than paddy as a single crop. The sowing of pulse, the third crop, has to be done when paddy is still in the field.

Effect of NPK on the yield of jute fibre

The trial was conducted with 3 doses of N at O, 44.8 and 89.7 kg. per ha., P at O, 22.4 and 44.8 kg/ha and K at O, 22.4 and 44.8 kg/ha, singly and in combinations. The study was also undertaken at the sub-station at Kendrapara (Orissa), Katihar (Bihar), Sorbhog (Assam) and Gograghat (U.P.). At Jute Agricultural Research Institute, it was observed that effect of higher doses of Nitrogen (89.7 kg./ha) was more pronounced in *C. capsularis* than in *C. olitorius*. Application of P or K had little effect. In *capsularis*, the highest yield of 26.4 q/ha was obtained from $N_2P_2K_0$ closely followed by $N_2P_1K_1$ (26.6 q/ha) and $N_2P_0K_2$ (25.7 q/ha) as against 11.0 q/ha from control. In *olitorius* trial $N_1P_1K_1$ gave the highest yield (20.1 q/ha), followed by $N_2P_0K_1$ (18.8 q/ha) and $N_2P_1K_0$ (18.4 q/ha) as against 12.5 q/ha from control.

At Kendrapara, 89.7 kg. N was much effective in *C. capsularis*. Application of P or K also increased the yield but not very appreciably at higher doses of N i.e. 89.7 kg/ha. Highest yield of 36.12 q/ha was obtained from $N_2P_2K_2$ closely followed by $N_2P_2K_1$ (35.3 q/ha), $N_2P_1K_2$ (35.3 q/ha) and $N_2P_1K_0$ (35.1 q/ha). However, application of

TABLE--X Trial with NPK : Yield of fibre. q/hectare
C. capsularis (JRC-212)
J. A. R. I. 1961

N K	P ₀				P ₁				P ₂				Grand Average
	Average				Average				Average				
	N ₀	N ₁	N ₂	Average	N ₀	N ₁	N ₂	Average	N ₀	N ₁	N ₂	Average	
K ₀	10·98	22·99	25·51	19·84	16·29	21·97	24·52	20·93	11·75	25·19	26·42	21·12	20·62
K ₁	16·57	22·04	22·70	20·41	9·64	21·93	25·64	19·07	15·16	20·09	24·84	20·03	19·84
K ₂	10·17	22·99	25·57	19·58	12·09	24·00	24·68	20·26	17·10	20·71	23·40	20·40	20·08
	12·57	22·67	24·59	19·94	12·67	22·63	24·95	20·09	14·67	22·00	24·89	20·52	20·18

P	P ₀	P ₁	P ₂	Av.
N ₀	12.57	12.67	14.67	13.30
N ₁	22.67	22.63	22.00	22.43
N ₂	24.59	24.95	24.89	24.81
Av	19.94	20.08	20.52	20.18

K	K ₀	K ₁	K ₂	Av.
N ₀	13.01	13.79	13.12	13.30
N ₁	23.38	21.35	22.57	22.43
N ₂	25.48	24.39	24.55	24.81
Av	20.62	19.84	20.08	20.18

K	P ₀	P ₁	P ₂	Av.
N ₀	19.83	20.93	21.12	20.62
N ₁	20.41	19.07	20.03	19.84
N ₂	19.58	20.26	20.40	20.08
Av	19.94	20.08	20.52	20.18

TABLE—XI Trial with NPK : Yield of fibre q/hectare

C. olitorious (JRO-682)

J. A. R. I. 1961

N	P ₀				P ₁				P ₂				Grand Average
	N ₀	N ₁	N ₂	Average	N ₀	N ₁	N ₂	Average	N ₀	N ₁	N ₂	Average	
K ₀	12.53	14.85	13.14	13.51	10.88	14.38	18.40	14.55	12.34	15.72	16.32	14.79	14.28
K ₁	11.21	13.73	18.80	14.58	10.21	20.08	16.43	15.57	12.59	14.35	16.93	14.62	14.92
K ₂	11.65	14.31	15.92	13.96	9.02	12.82	17.06	12.97	9.69	15.11	17.96	14.25	13.73
Av.	11.80	14.30	15.95	14.02	10.04	15.76	17.30	14.36	11.54	15.06	17.07	14.55	14.31

P N	K				K ₁				K ₂				P K	P ₀	P ₁	P ₂	Av.
	N ₀	N ₁	N ₂	Av.	N ₀	N ₁	N ₂	Av.	N ₀	N ₁	N ₂	Av.					
N ₀	11.80	10.04	11.54	11.13	11.92	11.34	10.12	11.13	11.92	11.34	10.12	11.13	K ₀	13.51	14.55	14.79	14.28
N ₁	14.30	15.76	15.06	15.04	14.98	16.05	14.08	15.04	14.98	16.05	14.08	15.04	K ₁	14.58	15.57	14.62	14.92
N ₂	15.95	17.30	17.07	16.77	15.95	17.39	16.98	16.77	15.95	17.39	16.98	16.77	K ₂	13.96	12.97	14.25	13.73
Av.	14.02	14.36	14.55	14.31	14.28	14.92	13.73	14.31	14.28	14.92	13.73	14.31	Av.	14.02	14.36	14.55	14.31

P alone increased the yield quite appreciably and $N_0P_2K_0$ gave 23.5 q/ha. as against 15.9 q/ha obtained from $N_0P_0K_0$ (control).

Effect of New fertilizer mixtures on the yield of jute fibre

The effect of fertilizer mixtures like Nitrophoska-blue (NPK), Nitrophoska-green (NPK) and Complezol received through Government of India, was studied against ammonium sulphate alone or along with P or PK and a control (no fertilizer) on the yield of *capsularis* and *olitorius* jute. Fertilizers were applied @ 33.6 kg. N/ha, P and K from superphosphate and muriate of potash were applied in the ratio as has been present in fertilizer mixtures. In *capsularis*, ammonium sulphate alone gave the highest yield (23.00 q/ha) followed by 'ammonium sulphate + superphosphate + muriate of potash' applied at the same proportion as in Nitrophoska-blue or green which yielded as 22.9 and 22.3 q/ha respectively. In *olitorius* jute, ammonium sulphate plus superphosphate gave the highest yield of 29.93 q/ha followed by ammonium sulphate alone (29.86 q/ha) and ammonium sulphate + superphosphate + muriate of potash applied in the proportion of 1 : 1 : 1 (29.8 q/ha). It is thus observed that in both the trials conducted in Nilganj, fertilizer mixtures did not show any appreciable advantage over ammonium sulphate alone.

Maximum potential studies on manuring on yield of jute fibre.

Responses of jute to increasing levels of nitrogen from 0 to 179.4 kg/ha applied either alone or along with PK (N : P : K 2 : 1 : 1) were studied under varied soil and climatic conditions of Nilganj (West Bengal), Sorbhog (Assam), Katihar (Bihar), Kendrapara (Orissa) and Gograghat (U.P.). Results from Katihar, Sorbhog and Gograghat have not yet been received. Data from Nilganj trial show that in *capsularis* jute highest yield of 30.1 q/ha is obtained from 179.4 kg. N/ha, 89.7 kg. P/ha and 89.7 kg. K/ha as against 20.7 q/ha from control. It further shows that the presence of PK is helpful only at very high level of N (179.4 kg./ha). At 89.7 kg. N/ha or lower levels, presence of PK does not increase the yield as compared to application of N alone. Second highest yield of 28.5 q/ha was obtained from 80.7 kg. N/ha. In *olitorius* jute yield did not increase with increasing levels of N either alone or

along with PK. Application of nitrogen at 22.4 kg./ha seems to be more economical.

At Kendrapara, the trial was conducted with *capsularis* jute only. Yield increased steadily with increasing levels of N alone up to 89.7 kg./ha which yielded 22.3 q/ha. When PK was added the yield increased still further and was highest at 179.4 kg. N/ha 89.7 kg. P/ha, 89.7 kg. K/ha giving 27.98 q/ha of dry fibre.

TABLE—XII
Maximum potential studies on manuring
J.A.R.I. 1961

Treatment	C. capsularis (JRC-212)			Cost of fertilizer Rs.	C. olitorius (JRO-632)		
	Yield of fibre q/ha.	Extra yield q/ha	Value of extra fibre @ Rs. 80'40/q.		Yield of fibre q/ha.	Extra yield q/ha	Value of extra fibre @ Rs. 80'40/q.
1. N ₀	20'69	—	—	—	25'13	—	—
2. N ₁	19'84	—0'85	—	41'93	28'48	3'35	269'34
3. N ₂	26'09	5'40	434'16	83'85	28'27	3'14	252'46
4. N ₃	24'99	4'30	345'72	125'78	27'83	2'70	217'08
5. N ₄	28'50	7'81	627'92	167'70	27'98	2'85	229'14
6. N ₅	26'44	5'75	462'30	335'40	27'00	1'87	150'35
7. P ₁ K ₁	16'27	—4'42	—	14'45	25'03	—0'10	—
8. N ₁ P ₁ K ₁	20'77	0'08	6'43	56'38	28'46	3'33	267'73
9. N ₂ P ₂ K ₂	23'85	3'16	254'06	112'75	20'30	3'17	254'87
10. N ₃ P ₃ K ₃	25'53	4'84	387'14	169'13	28'07	2'94	236'38
11. N ₄ P ₄ K ₄	25'93	5'24	421'30	225'50	28'85	3'72	299'09
12. N ₅ P ₅ K ₅	30'06	9'37	753'35	451'00	24'89	—0'24	—

N. B.

N₀ = 0 kg. N/ha.

N₁ = 22'4 kg. N/ha.

N₂ = 44'8

N₃ = 67'3

N₄ = 89'7

N₅ = 179'4

N : P : K = 2 : 1 : 1

Variety-cum-manure-cum-sowing practices

A composite experiment to study the effect of variety, manure and sowing practices with *capsularis* jute was continued. The varieties included the local type, D154 and JRC-212, the levels of manuring were M0, M1 (N 44.8, P 22.4, K 22.4 kg./ha) and M2 (N 89.7, P 44.8, K 44.8 kg./ha) and sowing practices followed were row cropping and broadcast. Germination was not quite uniform and the crop was adversely affected due to drought shortly after sowing. At later stages of growth there was a serious incidence of stem rot disease, details of which are reported under the head Mycology and Plant Pathology. Results show that the varietal responses were not much different from one another ; row cropping gave higher yield over broadcast sowing and manuring had singular effect, although the difference between M1 and M2 was small. Highest yield of 23.17 q/ha was obtained from JRC-212 sown in rows and manured at M1 as against 16.3 q/ha from control i.e. local type sown broadcast without manuring.

Spacing trial on fibre yield with capsularis jute.

The effect of various spacings in rectangular or square method of planting at 18" × 6", 18" × 12" and 18" × 18" with fixed or varying number of plants per hill as against control was studied with *capsularis* jute. The results show that 18" × 6" spacing having 4 plants per hill gives the highest yield of fibre (30.96 q/ha) followed by 12" × 3" having single plant per hill i.e. (control) (30.24 q/ha) and 12" × 3" having 4 plants per hill (29.56 q/ha).

Seed rate-cum-spacing trial with capsularis jute.

The crop was sown broadcast with 3 different seed rates of 5.6, 11.2 and 16.8 kg./ha. When the plants were very young, a wheel hoe fitted with a pair of sweeps was drawn at distances of 12" and 18" in one direction or across so as to leave the plants ultimately in bands of 12" and

18" or in hills of 12" × 12", 18" × 12" and 18" × 18". A control plot of line sown crop with usual 12" × 3" spacing was also included. There were all together 16 treatments. Results show that highest yield of 42.3 q/ha was obtained when scraping was done on either direction at 12" × 12" in a broadcast sown crop with 5.60 kg./ha seed rate. This was followed by control i.e. line sowing with 12" × 3" spacing (40.8 q/ha). As regards seed rate, 5.6 kg./ha was found to be advantageous over 11.2 kg./ha and 16.8 kg./ha.

Effect of interculture in Line and Broadcast sown crop of olitorius jute

Effect of interculture by a wheel hoe fitted with scraper i.e. sweep or tines in both row and broadcast sown crop were studied. The treatments included interculture by scraper or tines along or across the row cropped or in a broadcast plot followed by thinning or no thinning. There was a control row cropped plot receiving 2 weedings and thinnings plus 6 wheel hoeings. Thus in all there were 9 treatments.

Wheel hoeing and scraping between the rows in a row cropped plot followed by hand thinning with a usual spacing of 3" gave the highest fibre yield (27.92 q/ha) while wheel hoeing and scraping in one direction in a broadcast sown crop without any hand thinning, gave the second highest yield (26.28 q/ha). The control i.e. the row crop receiving 2 weedings and thinnings plus 6 wheel hoeings, gave exactly the same yield (26.28 q/ha) as that of the former.

Triple cropping experiment with jute, paddy, pulse (with varying dates of transplanting paddy)

First crop jute was sown by end of April and was harvested at 90, 105 and 120 days crop age. Jute sown on same date and harvested at later stages of growth, as in previous years, gave correspondingly higher yield of fibre. Paddy as a second crop after jute, yielded more grain as compared to single crop paddy, transplanted on same date. Paddy as second crop transplanted either by 1st August or 31st August gave lesser

yield as compared to 16th August transplanting. Earlier transplanting on the other hand gave increased yield of straw. Heavy manuring to paddy (second crop) resulted in depressing the yield of grain but enhancing the weight of straw. Khesari as third crop showed same trend in respect of manuring like the second crop paddy.

Triple cropping experiment with jute, paddy, pulse (with varying dates of sowing jute)

The first crop jute was sown in mid April, end of April and mid May and harvested at 120, 105 and 90 days crop age followed by a second crop of paddy. Two varieties of jute, one JRC-212 and the other JRC-321 were included in the study. Like last year, JRC-212 yielded more fibre as compared to early variety JRC-321 sown and harvested at same dates. Amongst the sowing dates, jute sown by end of April and harvested at 105 days crop age gave slightly higher mean yield as compared to earlier sowing by mid April and harvested at 120 days crop age. From double cropping purposes, date of sowing of the first crop of jute under Nilgunj condition, seems to be more important than stage of harvest. Paddy as a second crop after jute (late variety) yielded more or less same grain as compared to single crop Paddy, Khesari, the third crop, like last year responded in a similar way and the yield of grain was less in heavily manured paddy fields as compared to those moderately manured ones.

Effect of weedicide (Dowpon) in jute and jute field weeds

Effect of Dowpon applied as post emergence spray at various doses on jute and jute field weeds was studied with *olitorius* jute sown in rows. The doses tried were, 2.80, 5.60, 8.40 and 11.20 kg./ha as against no application as control with usual hand weeding. Application at the rate of 5.60 and 8.40 kg./ha seems to have checked the weeds better than other doses tried. The main crop jute was harvested and fibre extracted. Data on fibre yield show that the effect due to various doses tried have no significant difference on fibre yield. However, with increasing the

dose of Dowpon to 8.40 kg./ha, the yield increased and was more or less same.

The results indicate that application of weedicide (Dowpon) may check weeds (monocots) advantageously in jute fields and thus can replace hand weeding to an appreciable extent.

Manurial trial on *H. sabdariffa*

The trial was conducted in the same model as in last year. Ammonium sulphate was used at 3 levels of N as N_1 (44.8 kg./ha), N_2 (89.7 kg./ha) and N_3 (134.4 kg./ha). P and K each at one level in the form of superphosphate and muriate of potash respectively viz. P_1 (44.8 kg./ha). K_1 (28.0 kg./ha). Two treatments included Nitrogen with compost as the source.

In all there were 15 treatments including control. The crop was heavily attacked by foot-rot and stem-rot diseases, towards the later stages of crop growth ; there had been considerable mortality and the crop had to be harvested much earlier at flower stage. Although mortality was heavy, analysis shows that treatment effect was significant. Unlike last year, highest yield of 22.8 q/ha was obtained from N_1 (44.8 kg./ha) followed by N_1P_1 as against 19.1 q/ha from control. P and K appeared to have a little or no effect. Higher doses of N either as ammonium sulphate or compost, unlike last year, appeared to have no extra advantage but on the contrary made the crop susceptible to the diseases.

II.(b) UNIT : PLANT PHYSIOLOGY

Summary of work done last year.—*Investigations on the physiology of flowering behaviour were continued, with reference to certain definite problems viz., correlation of early or late flowering with the vigour of vegetative growth and photo-induction cycle brought about by changing temperature and available light periods. Some of the results have already been reported showing the response of olitorius and capsularis strain to temperature and light periods. Arising out of these studies, a new strain JRO-475 which flowered earlier by about a month, than JRO-632 the*

standard variety, was put to further yield test. In addition, seeds from the selfed capsules in selected plants in the early and late flowering populations have been kept for further studies.

Among the nutritional investigations, the application of nutrients as foliar spray gave higher yields with urea than that with ammonium sulphate. Urea was absorbed readily in the leaves and significantly increased the yield when compared with ammonium sulphate, which was more effective when made available through the soil. The effects of micronutrients like boron, copper, manganese, zinc and molybdenum were further studied in sand culture, along with different nitrogen contents in the culture media, to study the Nitrogen metabolism in both *capsularis* and *olitorius*.

The induced effects on the growth and development by the application of different synthetic hormones like IAA, IPA, IBA and NAA were continued in small field trials. The results confirmed the previous results that external growth in height and basal diameter; as well as the internal growth components like fibre bundles and fibre cells increased appreciably giving a significantly higher yield of fibre. This was more in *capsularis* types than in *olitorius* types.

(1) Experiments on Nutritional requirements

(a) *Foliar application of nitrogenous fertilizers as compared to soil application.*—Previous results have shown that foliar application of nutrients may be used as an alternative method of fertilizer application. In order to test the different fertilizer treatments, further experiments were continued under field conditions. The following treatments were repeated : (A) Top dressing of 45 kg. N/ha with ammonium sulphate, (B) Top dressing of 22.5 kg. N/ha plus foliar spray of 22.5 kg. N/ha with ammonium sulphate, (C) Foliar spray of 22.5 kg. N/ha with ammonium sulphate, (D) Top dressing of 22.5 kg. N/ha with ammonium sulphate, (E) Top dressing of 45 kg. N/ha with urea, (F) Top dressing of 22.5 kg. N/ha plus foliar spray of 22.5 kg N/ha with urea, (G) Foliar spray of 22.5 kg. N/ha with urea, (H) Top dressing of 22.5 kg. N/ha with urea. The types, *C. capsularis* : JRC-212 and *C. olitorius* : JRO-632 were taken.

In *C. capsularis*, JRC-212, it was found that ammonium sulphate at 45 kg. N/ha as top dressing gave a fibre yield of 35.41 q/ha and that with urea gave an yield of 33.78 q/ha, but when this 45 kg. N/ha was split up into 22.5 kg. N/ha as top dressing and 22.5 kg. N/ha as foliar spray, the yield in case of urea was 36.16 q/ha and that in case of ammonium sulphate was 34.62 q/ha. The above results showed that urea tended to give better performance when made available in the form of foliar spray and ammonium sulphate gave better results when applied to the soil. Similar trends were noticed during the previous year.

In *C. olitorius*, JRO-632, ammonium sulphate at the rate of 45 kg. N/ha as top dressing gave a fibre yield of 30.05 q/ha and that with urea, gave an yield of 32.14 q/ha, closely followed by 22.5 kg. N/ha with urea as foliar spray, which gave an yield of 31.88 q/ha. This indicated that urea when given as foliar spray even at lower level of nitrogen (22.5 kg. N/ha) was as effective as higher level of nitrogen (45 kg. N/ha) when applied as top dressing. Again when 45.kg. N/ha was split up into 22.5 kg. N/ha as top dressing and 22.5 kg. N/ha as foliar spray, the yield in case of urea was more than that of ammonium sulphate. In other treatments also, foliar application of urea was found to be more effective than foliar application of ammonium sulphate. These results indicated the efficacy of urea as foliar spray giving higher yields. This also confirmed the previous findings that the foliar spray with urea was more effective in *olitorius* than in *capsularis*, probably due to the bigger leaf size.

(b) *Effect of micro-nutrients on growth and development in JRC-212 and JRO-632.*—The effects on vegetative growth in height and basal diameter, root-growth, flowering time and the various deficiency symptoms have been investigated in presence or absence of such micro-nutrients as boron, copper, zinc, manganese and molybdenum, singly or in various combinations. During the year under report, further work was continued with reference to Nitrogen metabolism in presence or absence of boron, which was selected as the micro-nutrient, because of its dominant effect over the other micro-nutrients studied.

The experiments were conducted on JRC-212 and JRO-632, in replicated glazed pots having sand and the sustaining nutritive media

was that of Hoaglands with boron in conc. of 0.25 ppm and ammonium sulphate at 10 gms. per pot, as required. The vegetative and reproductive performances were recorded and the results obtained on the mean of 30 plants. It was found that Nitrogen was better utilized by the plants in presence of boron, showing vigorous growth in height and basal diameter, with good growth of foliage. In absence of boron, though requisite amount of nitrogen was available, the plants showed slower growth in height and basal diameter. The flowering time was also delayed. The deficiency symptoms like injury to apical growth, mottling and curling of leaves, brown patches with swelling and cracking of lenticels on the stem appeared late. This clearly indicated that Boron played an important part in nitrogen metabolism in plants.

(2) Investigations on the flowering behaviour

(a) *Early flowering strain of olitorius—JRO 55-475.*—Further experiments were continued to test the earliness of the above strain isolated in 1955. During the following years, the selfed seeds were sown and progeny, carried forward. On an average, the earliness of flowering varied from 23-25 days when compared to the standard JRO-632 during the previous years. During the period under report, the early strain JRO-475 and JRO-632 were sown simultaneously in four replicated plots in lines on 15.5.61. The date of first flowering in early strain was 13.7.61 i.e. 59 days from sowing date, as compared to the first flowering date of 14.9.61 in JRO-632 i.e. 112 days from the sowing date. Therefore, the earliness in the early flowering strain JRO-475 was noted to be 53 days in the year under report. In order to find the comparative yield performance, two harvests, at different stages were taken. The first harvest at the small pod stage of the strain JRO-475 and the second harvest later on, when JRO-632 came into the small pod stage, though the JRO-475 was over-ripe at this time. The early strain JRO-475 gave lower yields than that of JRO-632, the difference was about 5.53 q/ha in both the harvests.

(b) *Flowering behaviour of early and late formed capsules.*—The material from the following types of *capsularis*—D154, Fanduk, JRC-212, JRC-321 and Jap red, and in *olitorius*—JRO-632, JRO-620, JRO-

753, C. G. and R-26 with reference to their early and late formed capsules were selfed and seeds collected. The incidence of flowering and vegetative performance in height and basal diameter were also recorded. The weekwise percentage distribution of plants according to the incidence of first flowering showed the same trend of segregation into early and late flowering plants as noted before, i.e. a certain percentage of plants flowered early in the progeny population derived from early and late formed capsules. Selections were made according to very early or very late flowering of the plants. Many plants were damaged due to lodging.

(3) Investigations on the effect of synthetic hormones on the growth and fibre development

On the basis of results obtained 1st year, certain hormone treatments were followed up during the year under report. Field experiments were conducted in five replicated plots of 10' $\times$ 7' having a total area of 0.07 ha. (approx.) on JRC-212 and JRO-632. The hormones used were Indolyl propionic acid, Indolyl acetic acid, Indolyl butyric acid, Napthalene acetic acid in a single concentration of 500 ppm, which was found to be effective and economical from last year's experiments. The first spraying with hormones was done at about 32 days growth of the plants and the second spraying was done after an interval of 15 days. The weekly growth and the time of flowering were recorded. After harvesting, the green weight and fibre weight were recorded per average of 50 plants from each plots, as well as the total yield of replicated plots and the total stand counts were also made.

The results showed an increase in the fibre content as given in the table below, where the percentage increase has been represented on the basis of average of 50 plants as compared to untreated control plants.

The increase of fibre content in *capsularis* was found to be more than that of *olitorius*, which confirmed the differential nature of the integrated growth process in the two species as a result of cambial activity and apical meristem, reported in previous investigations. The above results have been confirmed by data taken on still larger population under field trials.

TABLE—XIII

Treatments	Percentage increase over control	
	JRC-212	JRO-632
IAA	137.00	108.96
IPA	130.00	—
IBA	123.50	109.26
NAA	111.85	101.91
Control	100.00	100.00

(4) Effect of Gibberellic acid on the Growth and Fibre development

The effect of gibberellic acid on the growth in length of the plants has been well established and it was thought profitable to investigate the same aspect in jute plants as the yield of fibre in jute is positively correlated with height and basal diameter of the main stem. So the following experiments were undertaken :

- (a) Treatment of seeds with different concentrations of 5 ppm, 10 ppm, 100 ppm & 1000 ppm, gibberellic acid, as compared to seed soaked in distilled water.
- (b) Treatment of the seedlings by spray or by swab method with conc. of 5 ppm, 10 ppm, 100 ppm and 1000 ppm, of gibberellic acid solution in pot cultures as well as in small plot experiments.
- (c) Treatment of the plants at different growth periods with gibberellic acid, in different concentrations, as above
- (d) Investigation on the effects on the length of the ultimate fibres and other internal growth components.

The results showed that gibberellic acid did not affect the germination percentage, which was similar to that of the control soaked in distilled water. But the after effects on the growth in length of the radicle

was more in the treatments of 5ppm, 10 ppm and in 100 ppm. In higher concentration of 1000 ppm, the radicle growth was very short, thereby showing that gibberellic acid is effective in a definite concentration. The effect was similar in both the seeds of JRC-212 and JRO-632. At seedling stage, spraying with gibberellic acid increased the length of the hypocotyle appreciably than that of non-treated ones. Further data were obtained from sprayings beginning from 20 days age of the plants with different concentration like 5 ppm, 10 ppm, 100 ppm, 1000 ppm. The rate of growth in height and basal diameter was recorded at seven days interval beginning from 20 days age of the plants up to the flowering stage. The lengthened growth of the stem was shown to be more with 5 ppm, than in 10 ppm or 100 ppm while deleterious effect was noted in 1000 ppm. It was also seen that the effect of gibberellic acid remained for a short period and periodic sprays were essential to get continuous effect. The corresponding effects on the increased green weight and fibre weight were also noticed.

Further, the effect on the length of the ultimate fibres which determine the quality of fibres was studied and the lengths measured after special smear technique and staining to isolate the ultimate fibres, from the different regions namely, bottom, middle and top of the stem, in collaboration with the anatomy unit. The statistical analysis showed significant treatment differences at 1% level in bottom and top portions and at 5% level in middle portion in the *capsularis* strains of JRC-212. In *olitorius* strain of JRO-632, the treatment differences in all the regions were found significant at 1% level. It was, therefore, seen that gibberellic acid was effective in lengthening the growth of the stem as a whole and also in lengthening the growth of the ultimate fibres which may be of economic importance in improving the overall yield and quality of the fibre.

III. SECTION OF AGRICULTURAL CHEMISTRY AND MICROBIOLOGY

Short summary of work done last year.—Effect of application of lime along with ammonium sulphate was studied and it was observed that total nitrogen and organic matter (organic carbon) increased with

the increase in the amount of nitrogen added, irrespective of liming. The fall in pH was comparatively less in limed plots as compared to unlimed plots. Exchangeable calcium had fallen. It was also found that the loss of added available nitrogen from ammonium sulphate was more in soils cropped with jute where pH was less. The rate of nitrification was also less in soils where pH had fallen. Application of superphosphate and compost prevented this deleterious effect to a certain extent. Application of superphosphate could not counteract the loss in exchangeable calcium in plots cropped with jute.

Copper fixation capacity of the soil increased while the availability of Manganese was reduced with increase in the amount of organic matter due to cultivation of jute.

In the 5 to 25% moisture level, fungal population decreased ; bacterial population increased with the increase in the moisture percentage. Study on the amino-acid make up of plants showed that the presence or absence of aspartic acid, glutamine, serine, leucine and α -amino butyric acid appear to influence the susceptibility of the plants to fungal attack and on the quality of fibre.

Investigations on the influence of Ca : K ratio and micronutrients on diseases were continued. Application of tops and non-fibre producing branches showed good results at different Substations (viz., Assam, Orissa and Uttar Pradesh), in the improvement of the soil.

By keeping the oxygen content of water at a higher level, the formation of 'Shyamla' colour could be retarded. Addition of a few sticks of Dhaincha (*Sesbania bispinosa*) with jute stems lowered the retting period in different Substations.

It was observed that during fungal retting of *Hibiscus cannabinus* and *Hibiscus sabdariffa*, hemicelluloses present in the plants decomposed.

Soil studies

Soil studies in relation to rotation of crops with Jute and Roselle : Chemical studies.—During the period under report, studies on the exhaustion of the soil due to growing of roselle (*Hibiscus sabdariffa*)

using mustard as indicator, were carried out only at the Jute Research Station, Katihar (Bihar). The yield of mustard fell considerably after a crop of roselle, both with and without fertilisers.

Studies on soils, where organic or inorganic nitrogen was applied continuously for 5 years singly or in combination, in different proportions and in varying doses, revealed several changes in the soil. The amount of nitrogen applied was the equivalent of nitrogen present in 2.5 to 40 metric tonnes of well rotten town compost per hectare. The changes observed were :

- (1) Total nitrogen and organic carbon increased.
- (2) The amount of exchangeable calcium decreased with the increase in the proportion of inorganic nitrogen.
- (3) With organic nitrogen alone, the fall in the amount of exchangeable calcium was not more than that in no-jute plots, though pH had fallen.
- (4) The loss of nitrogen was more from plots which received a greater proportion of inorganic nitrogen as compared to organic nitrogen.

In order to compare ammonium sulphate with urea, studies on nitrification were carried out with soil samples collected from fields receiving different fertilizers and manures and cropped with jute. It was found that availability of nitrogen from urea was more in soils which received ammonium sulphate and/or superphosphate for five years, but in other treatments it was same as ammonium sulphate. Retention of available nitrogen from applied urea was not affected by growing jute ; application of lime increased the retention capacity of available nitrogen. Application of superphosphate and compost was found to prevent the loss of applied nitrogen from urea. The application of lime or P_2O_5 in plots receiving ammonium sulphate prevented the loss of added available Nitrogen. In the heavily fertilized plots, which had received inorganic fertilizer and organic manures for five years, it was found that

loss of added available nitrogen was more in the plots receiving inorganic nitrogenous fertilisers. The rate of nitrification of added ammonium sulphate was also higher in the plots receiving organic manures.

Further studies on Cu-fixation capacity of soil under jute having different fertiliser treatment showed that Cu-fixation capacity was dependent more upon the soil-organic matter content than on other factors.

Water soluble manganese of Nilganj farm soil has been found to vary between 0.7 to 3.4 ppm., decinormal phosphoric acid soluble manganese varies from 60 to 120 ppm., hydroquinone-reducible manganese of the said soils has been found to vary between 86 and 218 ppm.

It has been found that after growing jute for 5 years with different fertilizers and manures :

- (1) the available manganese (as determined by decinormal phosphoric acid extraction) increased.
- (2) the increase in the amount of available manganese was related with the fall of pH.
- (3) application of lime prevented the increase of available manganese.
- (4) application of compost increased the phosphoric acid-soluble-manganese more than the addition of equivalent quantity of nitrogen from ammonium sulphate.
- (5) organic matter content had also an influence on the exchangeable, available and reducible manganese content of the soil.
- (6) pH remaining same, the availability of manganese decreased with the increase in organic matter.

Studies on manganese-fixation capacity of soils under jute, having different fertilizer treatments showed that the manganese fixation capacity was dependent more upon the soil reaction than on the amount of organic matter.

Studies on exchangeable aluminium revealed that

- (1) the exchangeable aluminium increased after growing jute.
- (2) the availability of soil aluminium increased with the fall in pH.
- (3) the availability of soil aluminium was more when inorganic acid producing fertilizers viz., ammonium sulphate, superphosphate, etc. were added.
- (4) liming was found to check this increase of exchangeable aluminium.
- (5) Application of organic manures like compost, could not affect the exchangeable Al. of the soil much.
- (6) exchangeable aluminium increased more with inorganic nitrogenous fertilizers like ammonium sulphate than with organic manures like compost.
- (7) when nitrogen, both from organic as well as inorganic sources was applied, exchangeable aluminium increased with the increase in proportion of inorganic nitrogen in the manure mixture.

Microbiological studies

The content of nitrogen-fixing soil microbes in the rhizosphere of the plots receiving various micronutrients for five years was found to change with the age of jute-crop. It increased up to 45 days, depressed at about 60 days and again showed a small rise when the crop was of 75 days. The plots, which received the micro-nutrients, fixed nitrogen in soil in a much better way than the control.

The effect of application of micro-nutrients in different doses during continuous cropping with jute for 5 years upon soil microflora was studied. It appeared that total bacteria and actinomycetes in the soil were lesser in number in treated than in untreated plots during fallow. But, irrespective of treatment, there was a trend of rise in the micro-flora-population during cropping, reaching the maximum just after harvest.

The rise in microbial population was found to be significant where the dose of borax was 8.5 Kg. and zinc sulphate was 3 Kg. per hectare for 5 years.

A new nitrogen-fixing bacterium.—A nitrogen-fixing organism has been isolated from the retting liquor of Gograhat plant sample. The bacterium fixes nitrogen in different carbohydrates ; maximum fixation of nitrogen nearing 30 mgm with 2 per cent glucose occurs in 30 days' incubation at 31-32°C. The growth of bacterium is quicker in combined nitrogen than in nitrogen deficient medium. It effectively utilises aspartic acid, glutamic acid, asparagine, ammonium acetate, sodium nitrate, peptone, alanine and urea. It shows very feeble and belated growth in ammonium sulphate and in glycine respectively.

The bacterium reduces nitrate, changes litmus milk alkali and is semi-transparent on incubation. The bacterium neither hydrolyses starch nor liquefies gelatine. Indol formation and catalase activity are found to be negative.

The bacterium differs from *Azotobacter*, *Beijerinckia* and also from the previously reported organism in cultural, physiological and morphological characters. It differs distinctly from *Derxia gummosa*. This has been included in the genus *Derxia* under a new specific name *Derxia indica* sp. nov and reported elsewhere.

Role of soil conditions affecting disease

Ca : K ratio of soil influencing plant growth.—The experiment was carried out in the same plots as in the previous two years. During the year disease conditions were not observed, but the best yield was obtained when the ratio of Ca : K (applied in soil) was 3 : 1, both with and without nitrogen as ammonium sulphate and not 2 : 1, as in the previous years.

Role of micronutrients :—Even in the fourth year of application of 90 Kg. of nitrogen as ammonium sulphate per hectare with different micronutrients, diseases could not be induced. The increase in the number of bacteria and actinomyces as reported elsewhere may be a

cause. At smaller doses, zinc, molybdenum, cobalt and particularly boron increased the fibre yield ; cobalt, zinc, boron, copper and molybdenum (particularly copper and molybdenum) increased the seed yield.

Retting

Quality of jute as affected by retting water.—In connection with a study on the difference in quality of jute produced in different places, it had been found that the samples of retting water from Uttar Pradesh contained more calcium and total solids than those in the samples from the districts of Nadia and 24 Parganas (West Bengal).

Influence of activators on retting period.—It had been found under laboratory conditions that use of *Hydrilla* reduced the retting period by about 3 days as compared to the control (15 days) ; while under field condition the period was more or less the same.

An experiment with magnesium phosphate in reducing the retting period in pilot scale was undertaken ; at 0.05% concentration of magnesium phosphate, retting period was reduced in laboratory as well as under cultivators' conditions.

An experiment was carried out under normal retting conditions to study the effects of the following on retting. (1) Aquatic plants (water hyacinth) (*Pistia*, *Hydrilla*) grown in retting pools, (2) addition of stem of *Dhaincha* (*Sesbania bispinosa*) in jute bundles and (3) addition of common salt, lime and hydrogen peroxide at various concentrations to the retting water. In treatments, where *Dhaincha* stems were incorporated and where sodium chloride was added, retting period was shortened by 3 days. Colour of the fibre was brighter where aquatic plants were growing and the best fibre was obtained from tanks where water hyacinth and *Hydrilla* were growing.

Retting of jute with *Aspergillus niger* in pilot scale, had been attempted successfully. Separation of jute fibre occurred within 8 days, though the quality was not good. Retting period with the enriched mixed cultures from Gograghat sample had been found to be very short

(about 1½-3 days) at temperature 35°C with fresh jute plants (about 3 months), but the retting properties of this mixed culture were lost, probably as a result of repeated subculturing.

Biochemical changes during retting.—Acetic acid, butyric acid, lactic acid and α -ketoglutaric acid were found in the retting system of jute. It was also found that the concentration of the acids was more at the middle phase of retting. The decrease in the acid concentration was due to their conversion to carbon dioxide and neutral substances.

Microorganisms responsible for retting.—3 cultures obtained from jute retting were purified and were tested for their pectinolytic and hemicellulolytic and retting properties. Of the 14 isolates obtained from ramie and the mesta retting systems, two isolates possessed pectinolytic properties and one had the property of decomposing gum arabic (hemicellulose).

Use of retting water as fertiliser for paddy.—As in previous years, retting water was found to give 11% higher yield of paddy over control in field experiments, this year also.

Retting of Ramie.—Several experiments were carried out in the laboratory. In the first set, decorticated ribbons were immersed in water allowing natural microflora to develop. In the second set, ribbons were inoculated heavily with *Bacillus subtilis* and *Aspergillus niger* separately, which were selected for their strong pectinolytic and hemicellulolytic activities. In the third set, sterilized ribbons were inoculated with *B. subtilis* and *A. niger* separately. Experiments were also carried with stems. Partially retted stems were taken out and then decorticated immediately or after drying the stem in sun, by hand. The microbial retting was carried out at temperature ranges from 31°C to 32°C.

Partially retted ribbons thus obtained, by the treatments mentioned above, were washed thoroughly with water and were then boiled with 2-10% sodium hydroxide solution in aliquots for 20-60 minutes. Such degummed ribbons were then bleached with 1% sodium hypochlorite

or calcium hypochlorite solution. Boiling with 7.5% alkali solution for 20 minutes proved to be the best. Retting with *A. niger* or with mixed culture requires very careful attention. If the retting was allowed to proceed slightly beyond a particular stage, the fibre became very weak.

With *B. subtilis*, however, fibre does not weaken even when the retting was continued beyond the previous point. Complete retting without chemical treatment was not possible with *B. subtilis* only.

IV. SECTION OF MYCOLOGY AND PLANT PATHOLOGY

Short summary of work done last year.— 4 fungi were repeatedly obtained from disintegrating remains of jute stubbles. Foliar spray of potassium nitrate on the susceptible type JRC-412, could not reduce stem-rot infection. Urea as foliar spray proved less harmful as a source of nitrogen and ammonium sulphate so far as diseases like stem-rot and root-rot were concerned. It was found that in some disease-free plots, a bacterium having antagonistic activity against *Macrophomina phaseoli* was present. The black spots on mature olitorius stem were found to be caused by *Phomopsis* sp. or by *Colletotrichum* sp. (not *C. corchorum*) or sometimes by both. Inoculation with spores of the *Colletotrichum* sp. could only infect such plants which received higher doses of nitrogen. The bacteria associated with the wilt disease of jute were isolated and their properties studied. Some selections have been made from indigenous capsularis types which escaped anthracnose infection in the field. Types selected for stem-rot resistance included No. 1172 and three others. Incidence of diseases on different capsularis varieties in the breeder's stock were recorded. The progeny from the cross D154 × JRC-412 were tested in the field and requisite selections were made. Nitrogen beyond 68.0 Kg./ha rendered jute crop prone to attack of stem and root-rot, while at 90.5 Kg./ha, N was definitely harmful and such harmful effects were hardly retarded by the application of P and K. Copper oxychloride with or without sticker behaved in a similar manner in checking leaf infection. Suitable selections were made from crosses between *Hibiscus cannabinus* and *H. radiatus* on the basis of freedom from anthracnose spots on stem. Deep ploughing had little effect on the incidence of foot-

rot in roselle. Oospore production in vitro was induced when *Phytophthora parasitica* was grown along with *Xanthomonas* sp. This explained the abundance of oospore formation in nature and its rarity in artificial culture.

***Rhizoctonia bataticola* (Taub.) Butler**

The perfect stage of *R. bataticola* (Taub.) Butler has been discovered. Flesh-coloured apothecia—4 to 22 mm wide—of the fungus was found to grow on the base of stems of *capsularis* jute plants though they were not parasitic on them.

The asci are thin-walled, hyaline, cylindrical, sometimes cylindro-clavate (but more cylindrical than clavate) inoperculate, with a terminal pore ; asci 206 to 306 long, mostly between 227 to 272 and 12.2 to 15 broad. Ascospores are single-celled, elliptical, hyaline, thick-walled, regularly eight in each ascus, 13.8μ to 17.2μ long and 6.9μ to 9.6μ broad, mostly $15.8\mu \times 8.6\mu$

The perithecia compare well with characters for *Orbilia* Fr. The species appears to be a new one and has been described as *Orbilia obscura* sp. nov. (Latin diagnosis and details will be published elsewhere).

The ascospores produced the typical culture of *R. bataticola* (Taub.) Butler, most of the strains of which are linked with the pycnidial form *Macrophomina phaseoli* (Maubl.) Ashby.

It has been noted that radio-active fall-out during the period of the growth of the fungus has been above the normal for the area. The plot, where these apothecia were found, was also near Cobalt⁶⁰ source situated in the south of the farm.

Study of the microflora of jute fields

Isolations were made from soil samples and debris collected from the rhizosphere of *capsularis* plants grown in a sick field. The fungi isolated were *Rhizoctonia bataticola*, and *R. solani*, form B, two unidentified members of mycelia sterilia of which one was chalky white and

formed thick strands on oat-agar and the other was thin brown and formed a sterile mat on potato-dextrose-agar. Others were, a *Chaetomium* sp, *Curvularia lunata* and *Fusarium solani*. There were two bacteria which, on the basis of frequency, could be taken as normal inhabitants in the rhizosphere soil of the particular sick plot.

Study of the biochemical changes in leaves of resistant and susceptible types

In the crown leaves of susceptible plants of a population of JRC-412, alanine and methionine were distinctly less in comparison to the crown leaves of resistant plants of JRC-918 of the same age. Similar trend was also observed in the basal leaves of susceptible and resistant types mentioned. Glutamic acid was less in the crown leaves of susceptible plants ; but the difference was marked in the basal leaves of the two groups. In highly susceptible plants, complete absence of aspartic acid, in the crown leaves, and serine in basal leaves was noted. In resistant types, however, aspartic acid and serine were present in substantial quantities in crown leaves and basal leaves respectively. In general the resistant plants were richer in the number and quantity of amino acids with the exception of amino-butyric acid which was found in the leaves of susceptible plants but not in the resistant plants.

On the antagonism of soil micro-organism against *Macrophomina phaseoli*

As reported earlier, a soil micro-organism having antagonistic property against *Macrophomina phaseoli* on potato-dextrose-agar was isolated.

Studies were conducted on the mutual effects on the growth of the fungus and bacterium using different media. At a given concentration, the bacterial culture could not check the growth of the fungus in case of sterile jute stick and straw media but was able to do this on potato-dextrose-agar medium.

Effect of nitrogen supplied as top dressing and foliar spray on the incidence of stem-rot

Records were taken in the experimental plot of the unit of Plant physiology. The crop was JRO-632 and the sources of nitrogen were

ammonium sulphate and urea. There were four treatments for each source, viz., 22.4 Kg. N/ha as foliar spray and as top dressing, 44.8 Kg. N/ha as top dressing alone, and 44.8 Kg. N/ha split equally as foliar spray and to dressing.

It was observed that with regard to stem-rot, there was not much difference between foliar spray and top dressing at 22.4 Kg. N/ha, the incidence was slightly more when source was ammonium sulphate.

Studies of pathogens other than *Macrophomina phaseoli*

The *Phomopsis* sp, isolated from *C. olitorius*, on inoculation, produced small black lesions on stem of *Hibiscus cannabinus* (M.T. 129) when plants were 60 days old.

The *Colletotrichum* sp, isolated from *olitorius* stem, did not attack stems of *H. cannabinus* on artificial inoculation.

The cultural characters of the two isolates were distinctly different on P.D.A., Richard's agar and host-extract-agar.

Investigations relating to control of diseases

Incidence of diseases in different types.—Incidence of diseases was recorded in a number of trials conducted by the Section of Breeding and Genetics. This indicated the performance of each type under field condition prevailing in Nilganj.

These data, along with those of the previous year suggest that CHy 52-6291, CHy 53-147, EC-4142 and C 57-211 are comparatively more prone to attack of stem-rot than others. Cx 53-8429 did not show root-rot infection in any of the six blocks.

Similar records were taken in *olitorius* varietal trial. JRO-753, JRO-620, JRO-632 and O-56514 showed comparatively better resistance to stem, rot and root-rot, but none was immune or even highly resistant. The statement is based on counts in 36 sample plots distributed in 6 blocks and totalling about 1500 plants per treatment.

TABLE—XIV

Record of stem-rot and root-rot infection in some capsularis varieties.

Culture		Mean P. C. stem-rot	Mean P. C. root-rot	No. of plants observed
CHy 52-6291	...	4.31	6.52	1627
CHy 52-6382	...	1.29	2.25	1379
CHy 52-9527	...	1.61	1.77	1427
CHy 53-147	...	4.13	1.72	1551
EC-4142	...	3.22	3.96	1380
JRC-206	...	2.60	4.07	1326
Cx 53-8429	...	0.53	0.00	1650
C 57-211	...	3.52	1.73	1325
JRC-212	...	1.04	1.52	1556
D-154	...	2.28	1.82	1384

Under field conditions prevailing in Gangetic alluvium of lower Bengal, *capsularis* strain JRC-212 was more resistant than D-154. However, improved *capsularis* strains were, in general, less susceptible to diseases than improved *ollitorius* strains.

Study of selections from the cross D154 × JRC-412

Four type selections along with the parents D-154 and JRC-412 were tried at Assam under ideal conditions for early sowing. It was found that the selection 226-1889 had combined to a large extent the desirable qualities of the two parents. The yield of D-154, 226-1889 and JRC-412 was 31.7, 25.2 and 21.3 q/ha respectively, while stem-rot per cent was 10.6, 13.3 and 28.0 respectively. 226-1889 flowered at the same time as JRC-412.

Influence of fertilizers on the incidence of stem-rot

In a replicated field trial of the section of Agronomy two levels of fertilizers were used viz. $N_2P_2K_2$ and $N_1P_1K_1$ against JRC-212, D-154 and a local *capsularis* strain, both in rows and broadcast. There was no basal dressing of any other manure. Jute was grown in the field since 1954 with mustard or field pea as the second crop in winter. The particular trial was started in 1959, when the incidence of stem-rot was

TABLE—XV

Table showing mean stem-rot, yield and flowering of selections from
D-154 × JRC-412 and parents.

Site : Assam, Sorbhog Sta. Replications : 6

Culture	Mean stem-rot p. c.	Flowering	Mean yield per plot (gms)	Yield (q/ha)
203-1856	15.9	Medium	11335.9	24.5
209-1871	24.5	Medium	4765.9	10.3
226-1889	13.3	Early	11657.5	25.2
233-1897	13.3	Medium	11165.0	24.1
JRC-412	28.0	Early	9839.4	21.3
D-154	10.6	Late	14679.4	31.7

imperceptible or even absent. In 1960 there were sporadic cases of stem-rot and in the year under report there was a heavy incidence of stem-rot.

TABLE—XVI

Incidence of stem-rot as influenced by variety, fertilizer and method of sowing.

Nilganj : 1961

Replications : 4

Variety	Treatment	Stem-rot percent		Mean of fertilizer treatment (stem-rot %)
		Row-crop	Broadcast	
JRC-212	N ₂ P ₂ K ₂	5.53	5.21	5.37
	N ₁ P ₁ K ₁	2.20	5.90	4.05
	N ₀ P ₀ K ₀	2.96	5.26	4.08
Mean for the variety		3.56	5.45	
D-154	N ₂ P ₂ K ₂	8.60	23.43	16.00
	N ₁ P ₁ K ₁	7.30	17.40	12.35
	N ₀ P ₀ K ₀	8.33	15.77	13.55
Mean for the variety		8.07	18.86	
Local	N ₂ P ₂ K ₂	7.96	17.64	12.80
	N ₁ P ₁ K ₁	11.00	19.05	15.02
	N ₀ P ₀ K ₀	10.73	17.42	14.37
Mean for the variety		9.89	18.03	

It was observed that JRC-212 resisted infection better than D-154 and the local. Row cropped plants resisted infection more efficiently than broadcast sown plants. The trial was conducted in grey alluvium where jute has been grown for eight successive years, and in 1961 the pH was 5.8 in the first 20 cm. of soil. In this plot, nitrogen though accompanied by potash, failed to check stem-rot. Plots where jute was continually grown with a consequent fall in pH needed liming, without which the application of potash alone could not help in checking stem-rot.

In plots cropped with *capsularis* jute followed by transplanted paddy and 'Khesari' successively there was no incidence of stem-rot disease in jute during the first three years.

Effect of crop rotation and pattern of cropping on the incidence of disease

(A general statement for both *capsularis* and *olitorius*)

Observations in cultivators' plots and cropping history of the different experimental plots of this Institute showed that the following cropping sequences have been beneficial both for yield and protection from diseases like stem-rot and root-rot. (Table XVII).

Survey of diseases in different States on the basis of reports of Jute Field Assistants (1955-60)

Assam.—Stem-rot and root-rot are common. Anthracnose has been second in importance, but confined to *capsularis* types only. Leaf mosaic in *capsularis* has been wide spread but less so in early sown plots.

Tripura.—As in Assam stem-rot has been in an epidemic form. Sporadic attack of *Physoderma corchori* in *C. olitorius* seedlings was reported only once in 1960.

North Bengal.—As in Assam leaf mosaic has been less intense. Die-back or black-band due to *Diplodia corchori* was common in seed plots.

TABLE XVII.—*Showing rotation pattern beneficial in Gangetic alluvium.*

1st year		2nd year		3rd year		4th year		5th year		6th year	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Jute	Mustard Pea Lentil	Jute	Potato Wheat	Jute	Kalai Lentil Pea	Jute	Lentil Pea Winter Vegetable	Dhain- cha (green manure)	Kalai Jowar (Fodder)	Repeat First year	
Jute	Trans- planted paddy	Jute	Trans- planted paddy	Dhain- cha (green manure)	Paddy (Trans- planted)	Jute	Trans- planted paddy	Jute	Trans- planted paddy	Dhaincha (green manure)	Kalai
Jute	Mustard Pea Lentil	Jute	Potato Vegetable (Cruci- ferae)	Maize Arum	Legume (Fodder)	Jute	Lentil Pea Khesari Mustard	Jute	Cowpea Kalai	Dhaincha (green manure)	Potato

Bihar.—Stem-rot and root-rot prevalent in Purnea and Saharsha, not so wide spread in other districts. Die-back in seed plots appeared in epidemic form in Muzaffarpur and North Purnea (Araria, Forbeshganj area).

Uttar Pradesh.—Stem-rot and root-rot not wide spread. Disease due to *Physoderma corchori* was present particularly in areas having high soil pH. In general, diseases are not as intense as in Assam.

West Bengal.—Stem and root-rot were wide-spread ; wilt has been epidemic in the jute-potato fields.

Orissa.—As in West Bengal.

General.—Diseases due to *Macrophomina phaseoli* were more wide spread and destructive in red soils than in new grey alluvial soils. Certain diseases like wilt are related to the cropping procedure such as rotation of jute-potato.

Relative efficacy of Fungicides in the Field

In an assessment of comparative efficacy of different fungicides, the following result was obtained with six sprays viz. 3 in June, 2 in July and 1 in August, covering a period of 55 days.

Incidence of stem-rot in JRC-412

Name of the spray				Per cent stem-rot.
CAPTAN	...	...	...	16.2
COPPESAN	...	...	...	16.6
COLLOIDAL COPPER	...	...	...	20.8
Control	...	...	...	21.9

The differences were not significant. In another trial the number of sprays of Coppesan in different strengths covered a shorter period of 45 days. The rate of spraying was 110 litres/ha in the first two sprays,

180 litres/ha in the next two sprays and 220 litres/ha in the third spray. A hand operated sprayer fitted with a low volume nozzle was used.

TABLE—XVIII

Incidence of stem-rot in plots treated with different strength of Coppesan

Coppesan : Strength	Stem-rot %	Collar rot %	Unclassified diseases
0.3%	... 9.9	7.5	1.2
0.5%	... 8.5	2.8	1.9
0.75%	... 9.3	3.2	1.6
Control	... 16.0	4.5	1.8

It was seen that coppesan, in all the three strengths used, reduced stem-rot. It had little effect on collar-rot or root-rot.

Breeding and selection for resistance to diseases in *Hibiscus cannabinus*

As stated earlier, 'mesta' suffers from a number of diseases. It has been assessed that of all the diseases, anthracnose is by far the most destructive. Culture Nos : My 124 and My 115 were brought forward which proved better than MT 129 and MT 150 with regard to diseases. Selection in 1961 was largely based on freedom from anthracnose in the late stage i.e. in the early-pod stage.

Effect of deep ploughing on the incidence of foot-rot.

This could not be followed up for want of equipment like a power cultivator or tractor.

However, deep ploughing by sub-cumb plough failed to effect any change on the incidence as compared to control plots.

Comparative study on the incidence of diseases in *H. cannabinus* and *H. sabdariffa*

Roselle (RT-2) and mesta (MT-129) were used in the study. It was found that in early stages during August, foot-rot due to *Phytophthora*

was about 11.2 and 4.6 per cent respectively. But in the later stages due to the activity of fungi other than *P. parasitica*, particularly *R. bataticola*, the root infection in mesta increased to 13.8 per cent.

Stem-rot due to *P. parasitica* during August was 0.2 per cent in roselle but was absent in mesta which, in turn, suffered from nodal canker due to other fungal pathogens.

While roselle was almost immune to anthracnose, mesta suffered heavily from this disease.

Effect of fertilizers on the incidence of Foot-and Stem-rot of roselle.

Nitrogen, irrespective of source, beyond 45 Kg./ha, definitely helped the spread and initiation of infection. From the distribution of the diseased plants in the trial, it appeared that soil moisture had greater influence on the incidence than the fertilizer treatments.

In a plot in the Institute, where heavy incidence of foot-rot in roselle was observed in 1959, liming was done @ 18.6 q/ha in 1960 and 1961. There was appreciably less disease in the plot.

Club root in Ramie

A new disease was observed in ramie. The symptoms included dwarfing of shoot, rolling and yellowing of leaves and abnormal swelling of the roots. The tissues within the root were found to be free from bacterium or fungus. It is presumed that the disease may be due to an unknown virus.

V. SECTION OF ENTOMOLOGY

Short summary of work done last year.— *Reciprocal exposures were given to larvae of Nupserha bicolor postbrunnea, below 2 per cent and approximately 16 per cent soil moisture content. Effect of these treatments on the larval phase and on the elimination of diapause was recorded.*

Two new chalcidoid parasites on Nupserha bicolor postbrunnea, viz., Neocatolaccus nupserhae and Norbanus acuminatus were described, and these two accounted for nearly 20 per cent of parasitisation.

Highest level of *Apion* incidence was recorded on the bottom portion of the stems of JRO-632 and JRC-212 during the first week of September and the second and third weeks of October. It has been observed that ovarian activity does not remain suspended during the winter months but the score becomes low.

A few parasites of *Apion* were collected. *Sisyropa formosa* Mensil and *Litomastix* sp. were recorded as parasites on *Anomis sabulifera*.

JRO-632, C.G., JRC-212, D154, (jute strains) ; MT-124, MT-129, (mesta strains) ; RT-1 and RT-2 (roselle strains) were tested for their relative susceptibility to *Meloidogyne incognita*. Roselle types were found to be much less susceptible to the pest. *Blumea lacera*, *Ageratum conizoides*, *Rungia parviflora*, *Oldanlandia corymbosa* were recorded as alternate hosts of *Meloidogyne incognita*.

JRC-212, JRC-321, JRO-620, JRO-632 (jute strains) ; MT-129 (mesta strain) ; RT-1 (roselle strain) were tried for their relative susceptibility to *Agrilus acutus* also. Highest incidence was recorded in jute, though casual incidence was noted in the previous year.

Five strains of mesta—269, 583, 584, 876, MT-15 were tested for assessment of their varietal susceptibility to *Agrilus acutus*. Incidence started from the second month except in MT-15 and 584, which were affected only from the 3rd month onward.

Capsularis (D154) and *olitorius* (C.G.) jute were raised in two separate layouts which were treated in previous years with different doses of DDT. No adverse residual effect has been noted in either.

JRC-212 and JRC-321 (*capsularis*), JRO-632 and JRO-620 (*olitorius*) were raised for apportioning the role of insects as pollinators vis-a-vis other agencies. Necessary selections before flowering with and without caging were made and relevant records were maintained.

Nupserha bicolor postbrunnea

(i) Reciprocal exposure of diapause larvae of *Nupserha bicolor postbrunnea* to low and high moisture treatments.—To study the effect of

reciprocal treatments of high (16% appr.) and low (below 2%) moisture in soil on the diapausing larvae, one laboratory experiment was set up in the previous year and was continued during the period under report. The trial included six treatments in four replications.

Reciprocal treatments were given after one and two months' intervals.

It has been found that morphogenesis occurred in treatments with exposure to low moisture in soil followed by high moisture contents. When exposed in the reverse direction, no evidence of morphogenesis was observed and the pest continued to remain in the diapause phase.

(ii) *Parasites*.—Observations were continued on the extent of parasitisation by different parasites. *Neocatolaccus nupserhae* and *Norbanus acuminatus*, reported during the previous year, were the two important ones from the point of natural parasitisation ; the former accounted for nearly 12 per cent and the latter, for about 9 per cent. Natural parasitisation by other parasites (which appear to be new species) was about 2 per cent only.

Apion corchori

(i) *Zonal distribution of incidence on stem during different periods of the season*.—For optimum utilisation of the spray on the region of maximum infestation on the stem of jute, the zonal distribution of incidence was studied again during the year under report.

Weekly observations were recorded on the incidence of the pest from the 3rd week onwards, from 100 selected plants of each of JRO-632 and JRC-212. In both species, preferences to infestation were more in the middle portions of the stems during the months of June, July and August and in the bottom portions, during September.

(ii) *Ovarial score during different periods of the year*.—Observations on the genital system made during the jute season and off season revealed maximum development of the ovules in the ovarian follicles in the month of August, indicating the highest egg laying potentiality or damage by

the pest during this month. There was also a gradual decline in the ovarial score from the month of September to January.

(iii) *Selection of Apion resistance.*—To study the resistance to *Apion*, 10 *olitorius* and 8 *capsularis* selections from the previous year were bulked and tried in two separate trials. Observations on the incidence of the pest were recorded. Bulkup materials in both *capsularis* and *olitorius* trials showed inconsistency in incidence pattern. Further selections have been made.

(iv) *Parasites.*—Of the three parasitic species recorded, only the miscogasterid remained active throughout the year. Parasitisation by the miscogasterid parasite was, at times, rather very high and exceeded 50%. The other two are, so far, unimportant.

Anomis sabulifera Guen

Insecticidal trial.—0.3% Sevin 85% WP, 0.1% Trithion 4E, 0.21% Telodrin 15% E.C. and 0.126% Malathion 50% E.C. have been tried in two separate cultivators' fields keeping 0.15% Endrex 20% E.C. as control. None of these proved to be superior to Endrex though Telodrin showed promise. No definite conclusion could, however, be drawn because of light showers that followed immediately after insecticidal sprays.

Role of insects in natural crossing

(i) *Olitorius jute.*—In continuation of the study taken up during the previous years, progenies were raised from selections of JRO-632 and observations recorded. It was observed that natural crossing in *olitorius jute* does not take place through the agency of wind, but through insects.

The mean value of cross pollination percentage during 1960-61 season was 5.26% only, the range being 2.90% to 14.38%. The range of the percentage of cross pollination in pods produced in 1960-61 and tested this year was, however, found to be 0.0% to 49.3%. It appears that rain is an important climatic factor which indirectly induces variations in the percentage of natural crossing in different years, apparently

by influencing the activities of the pollinating insects. It has been found that the pollinating insects show slightly more preference for *olitorius* flowers than *capsularis*. Cross pollination appears to be more in pods of the basal half of the floral-shoot.

(ii) *Capsularis jute*.—As in *olitorius* jute (JRO-632), progenies were raised from selections of JRC-212 and observations recorded. *Capsularis* jute is also cross-pollinated by insects and not by wind. The cross-pollination during 1960-61 season was 0.87%, with a range between 0.34% and 1.49%. The range of the cross-pollination percentage in pods was found to be 0.0 to 42.85. Like *olitorius* jute, cross-pollination has been found to be higher in pods of *capsularis* jute at the basal half of the floral-shoot, than those at the top.

Preference ratio of the pollinating insects for the flowers of the two jute species is—1 *capsularis* flower : 1.5 *olitorius* flowers.

Agrilus acutus

(i) *Prophylactic spray trial against Agrilus acutus*.—Prophylactic spray trial was undertaken to ascertain the possibility of reducing incidence of the pest, as in the borer stage control is rather difficult. For this, 0.05% and 0.1% of Dieldrin with 0.2% Tenac and without, have been used as prophylactic sprays during different stages of growth of *Hibiscus cannabinus*, with an interval of one month between treatments.

Incidence of the pest being very low, no definite conclusion could be drawn.

(ii) *Host preference studies with reference to jute and allied fibre crops*.—Two *capsularis* varieties (JRC-212, JRC-321), two *olitorius* varieties (JRO-632, JRO-620), one mesta variety (MT-129) and one roselle variety (RT-1) have been tested in connection with their relative susceptibility to the pest as in the previous year. MT-129 showed higher incidence level, indicating higher susceptibility to the pest as against RT-1. None of the jute types showed any incidence. The trend of incidence was similar to that observed in the previous year.

(iii) *Susceptibility of different strains of Hibiscus cannabinus*.—Five strains of *H. cannabinus* namely 269, 583, 584, 867 and MT-15 were included in this trial for assessment of their relative susceptibility as in the previous year. Incidences of the pest were recorded from all the varieties during different stages of growth. It has been observed that MT-15 showed nearly 5 per cent incidence during the fourth month stage of growth when incidences were maximum in all the strains. In strain 867, nearly 7 per cent incidence was recorded. In other strains, incidences were between 5 and 7 per cent.

(iv) *Susceptibility of different strains of Hibiscus sabdariffa*.—Five strains of *H. sabdariffa*, namely RT-1 (Gr.), RT-1 (N Br., Gr.), RT-2, RT-26 and N. P. Sab.—5 were included in the trial. Incidences of the pest were recorded from all the varieties during different stages of growth. It has been observed that susceptibility of the variety RT-1 (Gr.) appeared to be comparatively less as indicated by the lowest incidence level. Incidences were highest in all the strains during the fifth month stage of growth when 0.34% incidence was recorded in RT-1 ; in others, incidences were slightly higher than in RT-1.

Library

During the period under report 178 books have been added. This brings the total number of volumes to 3828, of which 1256 are journals. 119 sets of journals were obtained of which 86 were subscribed ; the rest were either complimentary copies, or received by exchange. 121 volumes were bound. Most of these were sets of journals.

A new set of furniture was procured for display of journals and for reading.

The library has been extensively used by the staff.

MISCELLANEOUS

Seminar :

Mr. B. Das Gupta of Botany Section delivered a series of lectures on the "Problems of Jute Breeding" and "Techniques of Jute Breeding".

Replying to questions by several members of the staff, Mr. Das Gupta discussed in detail about the fundamental difficulties faced during jute breeding.

Dr. T. Ghosh delivered a lecture on the attack of "*Physoderma corchori* on Jute". According to him, jute plants are usually attacked by this pathogenic fungus in water-logged, alkaline tracts.

The weekly seminar is expected to be resumed after the current jute season.

Training :

An intensive 10-days course of training in jute cultivation was arranged for Village Level Workers, Gramsevaks and other development staff from the states of Assam, West Bengal, Bihar and U.P. A total of 52 trainees, in three batches, starting on the 16th August, 28th August and 11th September, 1961, attended the training course which consisted of lectures and demonstrations on research and extension activities of the Institute by the members of the staff.

Consultative Committee :

In a meeting of Directors of various Agricultural Research Institutes held under the auspices of the I.C.A.R., it was decided that the Jute Agricultural Research Institute should have a Consultative Committee consisting of about fifty farmers or farming associations representing the interests of jute cultivation in different jute growing tracts of the country. The object is to bring the research workers in greater contact with the practical problems and to inform the farmers and their associations about the latest result of research in different fields of jute agriculture.

Accordingly, the Directors of Agriculture of different States were requested to nominate members from important jute growing zones. There has been very good response from individual farmers as well as from farming associations, who are keen to participate in the deliberations of the Consultative Committee.

So far, there has been no financial assistance to meet the travelling expenses of the members and as such, actual personal contact has not been up to the expectations. The Institute, however, has developed good contacts with growers and Block Development Officers of adjoining jute growing tracts and informations have been exchanged.

As personal contact between members of the Consultative Committee has not been satisfactorily established for other jute growing tracts, the Institute has, as an alternative, sent out to all members printed pamphlets on "Hints to Growers" (of jute).

High lights of research work done during 1961-62

A non-branching strain of *capsularis*, JRC-5854, was found to be suitable for U.P. The strain has been evolved through hybridisation involving five indigenous and three exotic types.

Inclusion of fibre : wood ratio as a criterion for selection, besides height and basal diameter, was found to give more dependable results.

Three selected strains of mesta, H. C. 583, H. C. 867 and H. C. 584 were found to yield significantly better than the control, M. T. 15, at 1% level.

"Tobacco leaf" variant, an isolate from X-ray irradiated JRO-632, was found to be more resistant to semilooper attack. A non-shattering pod type of *olitorius* has been isolated. Selections from irradiated JRC-919, yielding as high as the parental strain, but maturing about 30 days earlier have been obtained.

In both *capsularis* and *olitorius*, urea as foliar spray tended to give better results than ammonium sulphate as top dressing or as foliar spray. Nitrogen from ammonium sulphate was not economically utilised when supplied as a foliar spray.

For proper utilisation of nitrogen, boron was necessary and the absence of boron resulted in weak plants showing delayed maturity.

Spraying with 500 ppm of the hormone, indolyl acetic acid appears to improve the yield of JRO-632. The length of ultimate fibres increased in both species when treated with gibberellic acid.

Maximum potential studies on manuring of jute showed that in *capsularis*, the highest yield of 30 q/ha of fibre was obtained from 179.4 Kg. N/ha and at high levels of N, presence of P and K was helpful. Unlike *capsularis*, the yield of *olitorius* did not increase with increasing levels of N, either with or without P and K.

Under Nilganj conditions, paddy transplanted after jute on 16th August gave higher yield than paddy as single crop. Manuring of the second crop—paddy—resulted in increasing the weight of straw and depressing the yield of grain.

Labour required for intercultural operations forms the largest share of the cost of cultivation in jute. Weeding and mulching by wheel-hoes fitted with shares and tines have been found to practically eliminate hand weeding and thus reduce the cost of cultivation. The method can be used in both row-cropped and broadcast plots.

In soils fertilised with ammonium sulphate and superphosphate continuously for five years, the availability of N from urea increases. After cropping with jute available Mn and Al in the soil increased.

A new nitrogen fixing bacterium, *Derxia indica* has been isolated from a sample of partially retted *C. olitorius* collected from Gograghat, U.P.

A process for degumming ramie has been standardised. In this, *Bacillus subtilis* is first used for partial retting. This is followed by treatment with 75% NaOH and bleaching by hypochlorite solution.

The perfect stage of *Rhizoctonia bataticola* (Taub) Butler has been discovered.

Continuous cropping of the same plot with jute lowers the pH of soil and from the fourth year onwards, incidence of stem-rot starts. Such plots respond well to treatment with lime, potash and organic

manuring, particularly green manuring. Liming is also effective in reducing foot-rot in roselle.

Diapausing larvae of *Nupserha bicolor*, the ring pest of *olitorius* do not continue further morphogenesis when high soil moisture is present, as in potato fields, during winter months. This leads to a reduction of incidence during the following jute season. Low soil moisture during winter months favours further development. Since *Nupserha* is a borer, external application of insecticides is of little value. Methods of biological control are being worked out. In case of *Apion corchori* the maximum development of ovules in the ovarian follicles of the insect occurs during August. Control measures taken during this month are, therefore, most effective.

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APPENDIX

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work in 1962-63
I. BREEDING AND GENETICS OF JUTE Collection of varieties and types.	Six exotic samples of jute seeds, three <i>olitorius</i> from Russia, one <i>capsularis</i> and one <i>olitorius</i> from Bangkok and one <i>olitorius</i> from Portugal were received. The Russian materials did not germinate. 13 selections were made from Bangkok and Portuguese materials.	To be continued.
Nursery test.	Progenies of 95 <i>capsularis</i> selections including hybrid materials and selections from local types were raised in a nursery test along with the standard types as controls. The stand was very poor. 190 selections were carried forward for further studies.	To be continued.
Microplot test.	Four <i>capsularis</i> replicated microplot tests ('A' trials) were carried out. Liza, the very late exotic type, and the hybrid types JRC-7045, JRC-7027, JRC-7019 and JRC-10011 proved significantly superior to D154 in yield at 5% level.	To be continued.

Varietal trials.

(i) *Capsularis* varietal trial

A *capsularis* varietal trial with ten types including JRC-212 and D154 as controls, was carried out. The varieties JRC-206, E. C. 4142, and JRC-6382 proved significantly superior to D154 at 5% level.

To be continued.

(ii) *Olotorius* varietal trial.

In an *olotorius* varietal trial carried out with eight types including C. G. as control, the recommended variety JRO-632 proved significantly superior to all other types at 1% level, except JRO-514, with which it was in the same critical group.

To be continued.

(iii) Combined trial of *capsularis* and *olotorius* improved types

To compare the yield performance of the recommended improved types of *capsularis* and *olotorius* viz., JRO632, JRC-212 and D154 along with a new *olotorius* type JRO-514 and a very late exotic *capsularis* type JRC-206, a combined trial was carried out. The *olotorius* types JRO-514 and JRO-632 were both significantly superior to all the *capsularis* types at 1% level, yielding about 41 and 36 per cent higher respectively than D154.

To be continued.

— Simple varietal trials (sub-vention trials).

28 *capsularis* simple varietal trials with the types JRC-6382, JRC-9527, JRC-206, JRC-212 and D154 were allotted, 5 each to West Bengal, Bihar, Assam, Orissa and U. P. and three to Tripura. 26 trials

To be continued.

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work in 1962-63
Intervarietal and inter-specific hybridization.	were reported to have been sown of which six failed. Yield data of 16 trials only have so far been received. Results of <i>capsularis</i> and <i>olitorius</i> trials carried out in cultivators' plots during 1960-61 were as follows :— In Bihar, the data available were inadequate for statistical analysis. In Orissa, D154 closely followed by JRC-212 and JRC-5854 recorded the highest yield, though varietal differences in yield were not significant. In U. P., among the <i>capsularis</i> types, JRC-5854 and JRC-212 proved significantly superior to D154 at 5% level. Among the <i>olitorius</i> types in the same State, JRO-753 recorded the highest yield. (i) <i>Intervarietal hybridization</i> In all 1000 selections, 500 each in JRO-632 × OT-1506-F₅ and JRO-632 × OT-1507-F₅ were made. There was high mortality due to root-rot and stem-rot, and only 705 selections survived. Out of these 217 promising selections were carried forward. Seeds from two other intervarietal crosses viz.	To be continued.

Sudan Green $\times$ JRO-632- F_4 and Sudan Green $\times$ JRO-620- F_4 were collected for further studies.

(ii) Interspecific hybridization

The F_2 population of the interspecific hybrid *C. olitorius* $\times$ *C. capsularis* was severely affected by diseases and pests and very few plants survived, from which seeds were collected for further studies.

Further selections were made from the single plant progenies of the crosses JRO-632 $\times$ OT-1506 and JRO-632 $\times$ OT-1507, (both in F_3) including both erect and lodged plants and seeds were collected from the selections for further studies.

Fibre : wood ratio is a very important factor for fibre yield in jute and should be used as a third criterion for selection along with plant height and basal diameter, especially during the early stages of jute breeding.

89 strains, 70 of *C. capsularis* and 19 of *C. olitorius* were maintained as a source of germ plasm.

In addition, 5 wild species of *Corchorus* viz., *C. aestuans*, *C. fascicularis*, *C. tridens*, *C. trilocularis*, and *C. siliquosus* were grown for maintenance.

Colchicine induced polyploid materials of *capsularis* and *olitorius* were raised for maintenance of polyploid lines.

Lodging in *C. olitorius*.

Studies on the factors influencing fibre yield in jute.

Genetics of Jute.

To be continued.

To be continued.

To be continued.

To be continued.

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work in 1962-63
Inheritance of a new anthocyanin pigmentation pattern in <i>C. olerivius</i>.	The new anthocyanin pigmentation pattern in <i>C. olerivius</i> is characterised by a red dot at the base of the stipule and absence of pigment on all other parts of the plant.	To be continued.
UNIT : ALLIED FIBRES.	Collection of type materials.	To be continued.
BREEDING	<i>H. cannabinus</i> varietal trial.	To be continued if facilities exist.
One mesta varietal trial was conducted at the Central Station Farm. All three selected strains, H. C. 583, H. C. 867 and H. C. 584 were significantly superior to the control M. T. 15 at 1% level. The trial completed 3 years.	One mesta varietal trial was conducted at Jute Research Substation, Katihar, with 3 improved strains, M. T. 129 (L.L.), M. T. 150 (E.L.) and M. T. 102 (L.L.) and one control, a local type. The yield data are awaited.	To be continued if facilities exist.

To be continued if facilities exist.

The strains M. T. 129 (L.L.), M. T. 150 (E.L.), M. T. 166 (L.L.) and one local type were included in the varietal trials in cultivators' plots in U. P. conducted in 5 different centres. Of these, 3 trials were successful. Data are under analysis.

Hibiscus sabdariffa

Progeny test.

To be repeated.

A second year progeny row trial with 40 progenies including the control, was carried out. The trial failed due to heavy incidence of steam and foot-rot.

Microplot test.

To be continued.

One microplot trial "A" with 10 cultures including two controls, R. T. 1 and R. T. 2 was conducted at the central farm. Data are under analysis.

Varietal trial.

To be continued.

Three roselle varietal trials were conducted. The selected strains H. S. 4281, H. S. 4288, H. S. 4282 and H. S. 4278 proved significantly superior to the control, and R. T. 2 at 1% level. Data of other trials are under analysis.

HYBRIDIZATION

Intervarietal.

H. sabdariffa.

- (i) Bristle $\times$ non bristle characters.

Observations to be continued.

The F_1 , F_2 and F_3 progenies of R. T. 1 (N. B.) $\times$ R. T. 2 and also the progenies of the back crosses between the two parents, were grown in lines. Morphological observation and segregation counts were

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
(ii) Early flowering × late flowering.	made. Seeds were collected for observation in F₄ generation. F₁ progenies of <i>intermedius</i> × R. T. 2 were sown. Selections and records were made for observation in F₂ generation.	Observation to be continued.
(iii)		Fresh crosses to be attempted with different early and late maturing types.
INTERSPECIFIC		Attempts to be made to make reciprocal crosses between <i>H. canabinus</i> and <i>H. sabdariffa</i> .
Comparative yield trials with the miscellaneous fibre crops.	One comparative yield trial with <i>Urena sinuata</i>, <i>Sida rhombifolia</i>, <i>Malachra capitata</i>, <i>Hibiscus panduræformis</i>, <i>Abutilon indicum</i> and <i>Urena lobata</i> was conducted. Yield differences proved significant at 1% level. <i>Urena sinuata</i> gave the highest yield and proved to be significantly superior to all others.	Completed.

GENETIC STAINS

To be maintained.

In all 18 *H. cannabinus* strains, 14 *H. sabdariffa* strains, 6 strains of *Crotalaria juncea* and one strain each of *Urena sinuata*, *U. lobata*, *Malachra capitata*, *Hibiscus panduræformis*, *Sida rhombifolia*, *Abutilon indicum*, *Abroma augusta*, *Helicteres isora*, and *Thespesia lampas*, were maintained. Besides, 4 *Agave* sp. and one *Furcraea* sp. and *Raima* (*Boehmeria nivea*) were also maintained.

Unit Cytogenetics.

Irradiation studies using X-rays in jute.

Isolation and purification of variants for desirable economic characters.

Selfed and crossed seeds from the isolated and purified variants will be studied for segregation and performance in the X_5 generation.

The 'ornamental leaf' variant (40,000r) of JRO-632 yielded 9% more fibre per plant when compared to mother strain. The large leaves of stunted 'tobacco leaf' variant of JRO-632 (50,000r) were found to be resistant to semilooper attack; initial phase of growth of the variant is very slow and flowering, late by 26 days. True breeding 'non-branching' and pigmentation variants of JRC-919 from 30,000r and 40,000r treatments yielded 7% more fibre and those from 80,000r and 90,000r treatments matured 30 days earlier than the control JRC-919. Root-rot resistant types from 30,000r, 70,000r and 80,000r treatments of JRO-632 were isolated for purification. A 'large pod' variant with large broad (2 to 4 times) pods having 7 to 23 chambers and 27 to 412 seeds, has been isolated from the root rot resistant type of 30,000r treatments. Drought resistant types from 30,000r to 100,000r treatments coupled with earliness (23 days over the control) in some progenies of 40,000r and 70,000r treatments were isolated from

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
Cytogenetical studies of the induced mutants.	JRC-919 and JRC-212 at Gograghat, U. P. True breeding 'non shattering pod' types of JRO-632 (20, 000r, 40,000r and 70,000r) treatments were carried forward for study in X_3 from selfed seeds. 'Tobacco leaf' (50,000r) and 'crumpled leaf' (90,000r) variants with non-shattering pod character were back-crossed with mother strain. Segregation of characters e.g. time of maturity in JRO-632 and JRC-919, pigmentation variants in JRC-212, JRC-919 and a new pigmentation pattern 'deep red' stem variant of JRO-632 were studied. Somatic chromosome morphology of the 'soft stem' variant of JRC-212 arising out of 50,000r treatment has been studied ; no change in karyotype has been observed. Segregation of 'bushy top' character of JRC-212 of 100,000r treatment has been recorded. The sterile types e.g. 'crumpled irregular lamina' of JRO-632 (90,000r), 'ribbon leaf' of JRC-212 (90,000r) and 'starry leaf' of JRC-212 (70,000r) were cytologically analysed.	Further studies to be continued.
Irradiation studies using Gamma rays.	Bulked seeds from plants with beneficial physiological variations i.e. vigour and early maturity, from JRO-632 arising out of chronic gamma ray irradiation of 1,000r to 10,000r were studied for yield performance. Single plant selections for earliness, plant height and base diameter and disease resistance were	Further studies to be continued with selfed and crossed seed for isolation and stabilization of

beneficial characters.

studied. No variants except the stunted and late flowering types segregated. A new pigmentation pattern, with anthocyanin pigmentation distributed throughout the extra xylary portion of stem, has been isolated from JRC-212 irradiated with an acute dose of 36,000r gamma rays. Vigorous, late maturing types of JRO-632 selected from 40,000r acute gamma ray treatment (variants 91 cm taller and 7 to 15 days late maturing than the mother strain), as well as selections from the new pigmentation variant in JRC-212 were back-crossed with the respective mother strains. Morphological variants e.g. 'folded and curling lamina', 'deep serrated lamina', female sterile 'deep serrated irregular lamina' and 'stem fasciation' (JRO-632, 40,000r) and 'hard stem' (JRC-212, 36,000r) were isolated and carried forward for cytogenetical studies.

To be continued.

Selected tetraploids of JRC-212, JRC-919 and JRO-632 with thick hard stem, short internode and late flowering character, segregating early flowering types of JRC-919 and JRO-632 from 0.1% /6 hrs. treatment series were selfed and carried forward. Tetraploids and triploids were cytologically examined.

Further studies to be continued with fresh crosses after grafting.

No segregation was observed and F₂ population resembled the female parent in all respects in crosses of scions after reciprocal grafting of *C. aestuans* × JRC-212 and *C. aestuans* × JRO-632.

Study of colchicine treated series.

Interspecific hybridization.

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
Intervarietal hybridization.	In the F_3 plants from $4n$ C.G. $\times$ $2n$ JRO-632 crosses, besides 47% resembling the tetraploid female parent, 50% showing recombinations in flower and leaf characters, 3% new types with very slender stem and round leaf having deep serrations appeared. The types showed 83.9% pollen sterility and no seed setting. In the $4n$ DI54 $\times$ $2n$ JRC-212 crosses all the F_3 plants resembled the tetraploid female parent.	Further studies to be continued.
<i>Unit Anatomy</i> Study of the effect of X-rays and gamma rays on anatomical structures.	Histological study of the 'tobacco leaf' variant revealed an abundance of ergastic bodies eg., druses (clustered crystals of calcium oxalate) in the hypodermal cells and tannin containing cells in cortex, secondary phloem-ray zone in the extra-xylary portion of the stem. Multicellular glandular hairs are abundant on the lower surface and margin of the leaf. Cytohistological studies on the shoot apex of the X-ray variant 'disrupted phyllotaxy' from JRC-212 show that during leaf morphogenesis the stem apex gives rise to two leaf primordia from the same foliar foundation. Successive primordia do not arise in the typical left handed helix of normal JRC-212. Developmental anatomy of the 'double capsule' and 'whorled leaf' variants of JRC-212 has been studied.	To be continued.

Study of the bast fibre cells of jute.	In 'ornamental leaf' variant of JRO-632 (40, 000r) fibre bundles per unit area of bark are 9% more and L/B ratio of ultimate fibre cells is 162 (159 in mother strain).	Studies to be continued.
Anatomical peculiarities due to injury by Nematode attack in <i>C. capsularis</i> and <i>C. olitorius</i> roots.	Types of injury due to nematode in the different tissues of the stem and regeneration of tissues from the wound cambium in the different zones have been studied.	Study completed.
Anatomical studies of the Colchiploids.	Comparative studies on the anatomy and morphology of the leaf, stem and flower of the colchicine-induced tetraploids of JRO-632 and JRC-212 have been made. The size of leaf, stomata, flowers and pollen has been found to be larger than in the diploids.	To be continued.
II. AGRONOMY AND PHYSIOLOGY <i>Agronomy</i> : <i>Jute</i> . Manurial trials. Effect of NPK on the yield of jute fibre.	At Jute Agricultural Research Institute, with higher levels of N, better responses were obtained with <i>capsularis</i> but not with <i>olitorius</i> . Highest yield of 26.4 q/ha of fibre was obtained from $N_3P_2K_0$ as against 10.98 q/ha from control in the <i>capsularis</i> trial while in <i>olitorius</i> , it was 20.1 q/ha from N_1P_1	To be continued at Jute Agri. Res. Institute.

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
Effect of new fertilizer mixtures on the yield of jute fibre.	K_1 as against 12.53 q/ha from control. At Kendrapara also higher dose of N gave better response in <i>capsularis</i> jute and yield was 36.1 q/ha when PK was added (i.e. in $N_2P_2K_2$). Results from all the substations have not yet been received. Two trials, one with <i>capsularis</i> and the other with <i>olitorius</i> were continued at Jute Agricultural Research Institute. Neither in <i>capsularis</i> nor in <i>olitorius</i>, the fertilizer mixtures had any extra advantage over ammonium sulphate, which alone gave the best performance. In <i>olitorius</i>, ammonium sulphate together with super phosphate, gave the best results, closely followed by ammonium sulphate alone.	study concluded.
Maximum potential studies on manuring on yield of jute fibre.	To study the effect of increasing levels of nitrogen alone or along with PK on the yield of <i>capsularis</i> and <i>olitorius</i> jute, two trials each at J.A.R.I. Nilganj, Sorbhog (Assam) and Katihar (Bihar) were conducted. At Kendrapara (Orissa) and Gograghat (U.P.) the study was undertaken with <i>C. capsularis</i> only. Results from Katihar, Sorbhog and Gograghat have not yet been received. At J.A.R.I. highest yield of 30.60 q/ha of fibre was obtained from N 1. 79.4, P 89.7, K 89.7 Kg./ha in <i>capsularis</i> jute. Presence of PK appeared to be beneficial only with higher doses of N. In <i>olitorius</i>, however, the yield did not increase with increasing levels of N alone or along with PK	

and unlike *capsularis*, 22.4 Kg./ha appeared to be more economical. At Kendrapara the yield of *capsularis* increased steadily with the increasing levels of N alone up to 89 Kg./ha, but when accompanied with PK, the yield increased still further up to 179.4 Kg./ha, giving 22.24 q. and 28.09 q/ha of fibre respectively.

The study to be taken up in a modified form.

Variety-cum-manuring-cum-sowing practices on yield of fibre.

(*C. capsularis*).

The crop was badly affected due to drought shortly after sowing, which resulted in an uneven growth. It was also badly damaged by stem-rot at later stages. However, it was observed that row cropping gave higher yield than broadcast sowing, but there was no difference in yield due to varietal effect. Effect of manuring was quite evident; JRC 212 sown in rows and manured at M_1 (N 44.6, P 22.4, K 22.4 Kg./ha) gave the highest yield.

Trial could not be taken up for want of suitable land.

To be taken up.

Effect of various proportions of organic and inorganic manures on yield of jute fibre and maintenance of soil fertility.

Cultural trials.

Spacing trial on fibre yield with *capsularis* jute.

To be continued.

To study the effect of various spacings tried through rectangular or square method of planting, with varied number of plants per point, a trial was started with *C. capsularis* at J.A.R.I. Nilgani. The highest yield of 30.96 q/ha was obtained from 18" ×

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
Seed rate-cum-spacing trial on the yield of fibre with <i>capsularis</i> jute.	6" spacing having 4 plants per hill. This was followed by 30.24 q/ha. obtained from control i.e. 12" x 3" spacing having single plant per hill. Effect of broadcast jute sown with varying seed rates and using of a wheel-hoe fitted with a scraper or tines for interculture either in one direction or across so as to have the plants in lines of 12" x 18" at regular points, at 12" x 12", 18" x 12" and 18" x 18" distance, on the yield of <i>capsularis</i> jute was studied at J.A.R.I. Highest yield of 42.3 q/ha was obtained when scraping was done in both directions at 12" x 12" in broadcast sown crop with 5.6 Kg./ha seed rate. This was followed by control i.e. line sowing with 12" x 3" spacing which gave 40.8 q/ha. Advantage offered by the former is that the work can be managed with fewer hands.	To be continued.
Effect of interculture in line and broadcast sown crop of <i>olitorius</i> jute on the yield of fibre.	The trial was designed to study the effect of wheel-hoeing in one direction or across in both row and broadcast crops of <i>olitorius</i> jute. The result shows that wheel hoeing and scraping between the rows followed by hand thinning with usual spacing of 3" gave the highest yield of 27.9 q/ha of fibre as against 26.8 q/ha obtained from control i.e. two hand-weedings and thinnings plus 6 wheel-hoeings in a row crop.	To be continued.

Triple cropping practice.

Triple cropping with jute-paddy and pulses (with varying dates of transplanting paddy).

First crop, jute, was sown by the end of April and harvested at 90, 105 and 120 days followed by paddy. Paddy as second crop yielded more grain than paddy as a single crop transplanted on the same date. Transplanting of paddy on 16th August was better than doing it on 1st August or 31st August. Heavy manuring of paddy depressed the yield of grain but increased that of straw ; khesari—the third crop also responded to manuring in the same way. as paddy.

Study concluded.

Triple cropping with jute-paddy and pulses (with varying dates of sowing of jute).

First crop jute was sown by the middle of April, end of April and middle of May, and harvested at 120, 105 and 90 days respectively ; JRC-212 yielded better than JRC-321 when sown and harvested on the same dates. As regards sowing dates of jute, it was observed that sowing by mid-April and harvesting at 105 days yielded slightly higher fibre than either late sowing by mid-May and harvesting at 90 days or even earlier sowing by early April and harvesting at 120 days crop. age. For double cropping, the date of sowing of the first crop jute, plays an important role. Yield of paddy as a single or second crop was not different. Ksesari, the third crop yielded less in plots, heavily manured for paddy, as compared to those of lightly manured ones.

Study concluded.

Trials with weedicides.

Effect of weedicide (Dowpon) in jute and jute field weeds.

The effect of post emergence spray of Dowpon @ 2.8, 5.6, 8.4 and 11.2 Kg./ha on *olitorius* jute and

To be continued.

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
Allied Fibres. Manurial trial with roselle.	jute field weeds was studied. No significant differences in the fibre yield was observed as compared to that in control (hand weeding) thus the application of weedicide in controlling the jute field weeds appears to have a prospect. Trial with N.P.K. at different levels and their combinations was repeated. The crop was badly attacked by stem-rot towards later stages of growth ; hence it was harvested earlier. However, data show that the effect of fertiliser (N) was significant. Unlike previous year, 44.84 Kg./ha or 40 lb. N/ac. gave the highest yield of 22.82 q/ha as against 19.09 q/ha from control. Application of higher doses of N either from ammonium sulphate or from compost showed no extra advantage.	To be continued.
Unit Physiology : Nutritional Investigations. Foliar application of nutrients.	Previous results were confirmed in that urea was more effective as foliar spray in <i>olitorius</i> than in <i>capsularis</i> whereas ammonium sulphate was found to give more yield as top dressing.	To be continued in a modified form, combined with foliar application of hormones.

Effect of micro-nutrients.	Experiments were continued in presence or absence of boron, when nitrogen was made available, to see the effect of nitrogen metabolism. The results indicated that boron played a role in nitrogen assimilation.	To be continued.
Investigations on flowering behaviour.		
Flowering behaviour in the early flowering strain of JRO-475-55.	The strain was further tested. An earliness of 53 days was recorded. The yield was tested by two split harvests, at small pod stage of the early type and the other at that of JRO-632. The early strain yielded less than JRO-632 at both harvests.	To be continued.
Flowering behaviour of the early and late formed capsules.	The materials from D154, Fanduk, JRC-212, JRC-321 and JRO-632, JRO-753, C. G. and R-26 were sown, the flowering behaviour recorded, and early and late formed seeds were collected from selfed for further studies.	To be continued.
Investigations on the effect of synthetic Hormones on Growth and Fibre development.	The encouraging results, obtained last year, were further followed up. Spraying with 500 ppm conc. with different hormones increased the vigour of growth and output of fibre by 11 to 37% in <i>capsularis</i> —JRC-212 and 1 to 9% in JRO-632. IAA gave the maximum increase followed by IPA in JRC-212.	To be continued.
Effect of gibberellic acid on growth and fibre development.	Significant increase in the growth of the stem as well as in the length of the ultimate fibres was noted, giving a corresponding increase in the fibre yield ; the lengthening of the ultimate fibres is known to give better quality of fibre.	To be continued.

Programme of work as sanctioned	Progress of work in 1961-62	Future programme of work for 1962-63
III. AGRICULTURAL CHEMISTRY AND MICROBIOLOGY	Changes due to repeated application of nitrogen from organic and inorganic sources, for 5 years, singly or in combination, in different proportions and in varying doses were studied. The amount of nitrogen applied was the equivalent of nitrogen present in 2.5 to 40 metric tonnes of well-rotten town compost per hectare. (i) Total nitrogen and organic carbon increased. (ii) The amount of exchangeable calcium, decreased more with the increase in the proportion of inorganic nitrogen. (iii) With organic nitrogen alone, the fall in the amount of exchangeable calcium was not more than that in plots without jute, though pH had fallen. (iv) The loss of applied nitrogen after N was applied, was more from plots which received proportionately more inorganic nitrogen than organic nitrogen.	Further studies on the K-status of the soil.
<i>Soil studies</i>		
Soil studies in relation to rotation of crops with jute.		Study of nitrification will be continued.

Studies on the micro-nutrients to be continued.

Application of lime increased the retention capacity of available nitrogen ; P_2O_5 and compost helped to prevent the loss of applied nitrogen. Copper-fixation capacity was dependent more upon the organic matter content than on pH.

Available manganese content increased with the fall in pH of soil. Organic matter also influenced the availability manganese. Manganese fixation depended more on pH than on organic matter content of soil. Exchangeable aluminium content increased after a crop of jute and more with acid producing fertilizers lime ammonium sulphate and superphosphate. Liming prevented the increase in the available aluminium content. The exchangeable aluminium content of the soil increased with the increase in proportion of inorganic nitrogen.

Microbiological studies.

Changes in nitrogen-fixing soil microbes including actinomycetes in the rhizosphere were studied. A new nitrogen fixing organism *Derxia indica* was isolated from the retting water.

Studies on nitrogen fixation in soils ; studies on seed inoculation with nitrogen fixing microbes.

The best yield of jute was obtained when Ca : K (applied to the soil) was 3 : 1 in the plots where previously best response was obtained at the ratio 2 : 1. Boron in particular was found to increase the fibre yield, and copper and molybdenum the seed yield.

Studies on the rhizosphere, on the amino acid makes up of plants grown under different conditions

Role of soil conditions regarding susceptibility to diseases.

Programme of work as sanctioned.	Progress of work in 1961-62	Future programme of work for 1962-63
Influence of soil conditions on the soil texture.	Work was continued at the Substations. It was found that retting waters from Uttar Pradesh contain more calcium in comparison with retting waters of Nadia and Murshidabad (West Bengal).	and on the micro-nutrients applied to soil.
Quality of fibre.		To be discontinued
Colouration of fibre.		Study on the nitrogen content of fibres as affected by different soil conditions.
Retting of jute.	<i>Hydrilla</i> lowered the retting period under laboratory conditions. Magnesium triphosphate at 0.05% reduced the retting period under pilot condition.	Study on removal and prevention of reddish-brown colour as produced in Bihar.
Action of activators.		Study on the effect of natural and synthetic activators and aquatic plants to be continued.

In pilot scale (under cultivators condition) addition of *Dhaincha* (*Sesbania bispinosa*) stems and sodium chloride lowered the retting period whereas colour of the fibres was best from tanks where water hyacinth and *Hydrilla* were growing. The mixed culture from Gograghat sample lost its retting property on separation and purification.

With *Aspergillus niger* fibres could be separated but were of bad quality.

Biochemical changes during retting.

Micro-organisms responsible for retting.

Use of retting water.

Additional work.

Retting of ramie.

Acetic acid, butyric acid, lactic acid and α -Ketoglutaric acid were found in the retting system during the middle phase of the retting.

3 cultures obtained from jute retting systems were purified and tested for their pectinolytic and hemicellulolytic properties. Of the 14 isolates from ramie and mesta retting systems, only two isolates possessed the pectinolytic properties and one had the hemicellulolytic properties.

Irrigation with residual water from retting tanks gave 11% increase in yield of paddy over control in field experiment.

Good quality fibres were obtained by microbiological process followed by chemical treatments. Best

Studies on fungal retting to be continued.

Further study to be continued.

To be continued.

To be continued.

To be continued.

Programme of work as sanctioned.	Progress of work in 1961-62	Future programme of work for 1962-63
results were obtained when ribbons were inoculated with <i>Bacillus subtilis</i> and retting was allowed to continue up to a particular stage followed by a treatment with 75% sodium hydroxide solution for 20 minutes and bleached with 1% calcium hypochlorite solution. IV. MYCOLOGY AND PLANT PATHOLOGY Study of the micro-flora of Jute field. Investigation on the fungi of the rhizosphere of plants in healthy and sick jute field and that of the rhizoplane. Study of the stem-rot fungus and associated organisms.	A number of fungi and bacteria from the rhizosphere of plants (<i>capsularis</i>) from sick fields were isolated. The perfect stage of <i>Rhizoctonia bataticola</i> was discovered, described and identified.	Study of the fungi and bacteria from sick and normal soils. Inoculation tests against <i>C. capsularis</i> with cultures obtained from ascospores. Detailed study of the morphology of <i>Macrophomina phaseoli</i> will be made.

Study of the biochemical changes in leaves of resistant and susceptible types.

Study of the effect of foliar application of potash on JRC-212 of different ages.

Incidence of diseases in different *capsularis* varieties.

Influence of fertilizers on the incidence of stem-rot.

The type and nature of amino-acids in 2 known susceptible and resistant types were described. This may help elucidation of pathogenicity of *M. phaseoli*.

This was replaced by study of foliar application of nitrogen on *olitorius* crop.

It was found that N at 22.4 Kg./ha, whether in foliar application or as top dressing, did not incite much stem-rot. But disease increased when N was 44.8 Kg./ha, and was more so when ammonium sulphate was the source.

Records were taken and on the basis of previous and current years' records, and the more susceptible ones were marked.

It was found that eight years continuous cultivation of jute in same plot lowered the pH to 5.8. Potash did not prevent the disease in this plot. There was not much difference in the two treatments N 89.2 P 44.8 K 44.8 Kg./ha and N 44.6 P 22.4 K 22.4 Kg./ha.

Programme of work as sanctioned.	Progress of work in 1961-62	Future programme of work for 1962-63
Selections from D154 x JRC-412 are to be tried at Sorbhog & Gograghat for yield etc.	An yield trial was conducted at Sorbhog, Assam and No : 226-1889 has been found to have combined the desirable qualities of D154 and JRC-412 to a large extent. Trial at Gograghat could not be conducted.	Records will be taken in field trials, if any, conducted by the section of Agronomy.
Relative efficacy of fungicides in the field.	Copper-oxyshloride with six sprays, covering a period of 55 days was effective, but not economic.	Seeds to be multiplied at Nilganj. New fungicides will be tried.
Study of the effect of different rotations.	A detailed rotation of crop has been suggested on the basis of observations made in cultivators' fields and experimental results.	
Survey of status of diseases in States on the basis of reports from field assistants.	It has been found that diseases due to <i>Macrophomina phaseoli</i> were more wide spread and destructive in red soils than in new alluvial soils. <i>Phyodermma corchori</i> was confined to Uttar Pradesh and Tripura. Anthracnose was important only in Assam and Diplodia in the Terai region.	
Preliminary investigations on the antagonism of soil micro-organisms against <i>Macrophomina phaseoli</i>.	Growth behaviour of the bacterium and the fungus has been studied on different media.	Fresh isolations of bacteria antagonistic to <i>Macrophomina phaseoli</i> will be attempted.

Condition favourable for growth of the bacterium in stock, will be ascertained.

The identification of the *Colletotrichum* and *Phomopsis* sp. will be attempted.

Selected types will be multiplied.

Seeds to be multiplied at Substations.

My-124 along with some more selections, will be put in field trial to

Study of pathogens other than *Macrophomina phaseoli*.

Inoculation studies with *Colletotrichum* sp. on *olitorius* jute and *Phomopsis* sp. on the same.

Phomopsis sp. from *olitorius* stem infected both *Hibiscus cannabinus* and *C. olitorius*. The *Colletotrichum* sp. from *olitorius* stem failed to attack mesta stem.

Investigations on the control of jute diseases.

Selection for resistance to stem rot.

Seed of 1172, and 11642 have been multiplied in small plots.

Diseases of fibre crops other than jute.

Selections from *H. cannabinus* × *H. radiatus* against disease, particularly anthracnose.

Selection My-124 has shown some promise against anthracnose under field condition.

Programme of work as sanctioned.	Progress of work in 1961-62.	Future programme of work in 1962-63
Studies on the effects of manures and fertilizers on the incidence of foot- and stem-rot in roselle.	Liming @ 1800 Kg./ha reduced the incidence to a great extent. Nitrogen beyond 45 Kg./ha definitely helped spread of the disease. P and K had little retarding influence when the field has been under roselle for six continuous years.	assess yield and resistance to anthra-nose.
Effect of deep ploughing on the incidence of foot- and Stem-rot in roselle.	Sub-cumb plough failed to retard the incidence of the disease.	Effect of lime, nitrogen, phosphorus and potash on incidence of diseases, will be assessed in field trials.
Relative resistance of mesta and roselle to diseases.	A detailed observation was made. Mesta suffered more from diseases and particularly from anthracnose in the later stages.	Effect of PCNB on the incidence of foot and stem rot in roselle to be studied in a field trial.
	A new diseases of ramie was reported. This is termed as club-root of ramie and is presumed to be due to a virus.	The etiology of the club root disease of ramie may be studied if conditions permit.

Causes of leaf
rot of sisal to be
investigated.

To be continued.

To be continued.

To be continued.

To be continued.

To be continued.

It has been found that morphogenesis occurs in treatments with exposure to low moisture followed by exposure to soil with high moisture content. When exposed in the reverse direction, evidence of morphogenesis was not observed.

Neocatococcus nupserhae accounted for nearly 12 per cent and *Norbanus acuminatus* for about 9 per cent parasitisation.

In JRO-632 and JRC-212, infestation was more in the middle portion of the stem during the months of June, July and August and in the basal portion during September.

Maximum development in ovarian follicles was observed during August.

Some selections were bulked up and tested but no encouraging results were obtained.

V. ENTOMOLOGY

Nupserha bicolor postbrun-
nea Dutt.

Reciprocal exposure of diapause larvae to low and high soil moisture treatments.

Parasites.

Apion corchori Marsh.

Zonal distribution of incidence on stem during different periods of the season.

Ovarial score.

Selection for resistance.

Programme of work as sanctioned.	Progress of work in 1961-62	Future programme of work in 1962-63
Parasites.	Of the three parasites recorded, only miscogasterid remained active throughout the year. Parasitisation by the miscogasterid parasite exceeded 50% at times.	To be continued.
<i>Anomis sabulifera</i> Guen.	Insecticidal trial. 0.3% Sevin 85% WP ; 0.1% Trithion 4E ; 0.21% Telodrin 15% E.C. and 0.126% Malathion 50% E.C. have been tested in the cultivators' fields for assessment of their comparative efficacy, keeping 0.15% Endrex 20% E.C. as control. None of the insecticides was found to be superior to Endrex 20 E.C.	To be continued.
Role of insects in effecting cross pollinations.	It has been found that <i>olitorius</i> jute is not wind pollinated. Insects are responsible for effecting cross pollination. Rain appears to induce variations in the percentage of natural crossing in different years.	Studies on insect pollinators.
<i>Olitorius</i> jute.	Like <i>olitorius</i> jute, natural crosses in <i>capsularis</i> are also effected through the agency of insects. Preference of pollinating insects for flowers of <i>olitorius</i> jute is only 1.5 times more than for those of <i>capsularis</i> .	Studies on insect pollinators.
<i>Capsularis</i> jute.		

Agrilus acutus Thunb.

Insecticidal trial.

0.05% and 0.1% of Dieldrin with 0.2% Tenac and without were tried as prophylactic sprays. Incidence of the pest being very low, no conclusion could be drawn.

To be continued.

Host preference studies with reference to jute and allied fibre crops.

JRC-212, JRC-321, JRO-632, JRO-620 (jute strains), MT-129 (mesta strain) and RT-1 (roselle strain) were tested in the trial. MT-129 showed higher incidence as against RT-1. No incidence was recorded on jute types.

To be continued.

Varietal susceptibility of mesta types.

Five strains, viz., 269, 583, 584, 867 and MT-15 were in the trial. MT-15 showed lowest incidence.

To be continued.

Varietal susceptibility of roselle types.

Five strains viz., RT-1 (Gr.), RT-1 (N BR. Gr.), RT-2, RT-26 and N. P. Sab.-5 were included in the trial. RT-1 (Gr.) showed the lowest incidence.

To be continued.

